THE

# JOURNAL OF GAS LIGHTING,

## WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. VIII. No. 181—11th YEAR.] LONDON, SEPTEMBER 27, 1859. [Subscription per Ann. {15s. in Advance / 18s Credit.] Price 6d. Unstamped.

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## NOTICES.


The subscription is 15s. per annum, if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, in July and January of each year. Post-Office orders must be made payable at the Charing-Cross Money-Order Office, to William H. Bennett, No. 42, Parliament Street, Westminster.

The next number will be published on Tuesday, Oct. 11, and the subsequent numbers on each successive alternate Tuesday.

Stamped copies, when forwarded by post, must be folded so as to expose the stamp; they are otherwise liable to the full postage charge for letters.

This JOURNAL has been duly registered at the General Post Office for transmission abroad.

All Communications to be addressed to the Editor, No. 42, Parliament Street, Westminster; and orders for Advertisements to the Publisher, Mr. W. B. King, No. 11, Bolt Court, Fleet Street.



# THE JOURNAL OF GAS LIGHTING,

## WATER SUPPLY, & SANITARY IMPROVEMENT.

*TUESDAY, SEPTEMBER 27, 1859.*


### NOTES UPON PASSING EVENTS.

On one occasion, when the liveried "snobs" of the *Académie des Sciences* waited upon Napoleon the First with some fulsome compliments, or some sacrifice to the power of the day, he uttered the very sensible wish that his flatterers would at least "respect the republic of letters." What a pity it is that the so-called representatives of Science in England should have forgotten this tale, or should have been callous to the rebuke it conveys to all who, in their position, will so far forget the dignity of science as to run about after the smiles and the protecting eloquence of princes and courtiers! We had believed better things even of the peripatetic dabblers in Science who rush about the country under the name of the British Association; and it was, therefore, with a deep sense of humiliation that we read the account of the opening of the Meeting at Aberdeen. The fault, as we regard the matter, lies, however, entirely with the obsequious "tuft-hunters" of the Association, not with the Royal Prince who was induced to lend his name to the farce—for he, indeed, did everything which could have been done to retrieve the blunder of those who were supposed to represent the true interests of Science. If ever patronage might be accepted without disgrace, it would be when exercised by a man so perfectly aware, as H.R.H. Prince Albert seems to be, of the duties attached to such an office; but it is precisely on account of the virtues and the talents of the Prince himself that the precedent thus established becomes the more dangerous, because a system of Royal patronage thus begun may be the more easily admitted, and the more firmly established. The duties of President of such an Institution are, of course, purely nominal, at present at least; but when that body becomes, by its connexion with Royalty, the authorized organ of communication between the State and certain branches of Science, are we not at once exposed to all the dangers of Court intrigue and of Court favour? Something of this kind may already be observed in the intercourse between the Court and the leaders of the Association; for, as Mr. Carlyle might say, there has already been drawn a line between the "omoioians" and the "upomoionians;" and the vulgar herd of members have been treated with even less respect than the "conipodian antochtones" of Braemar. Thus it will always be we fear, however; the leaders of organized scientific or literary bodies are too often ready to offer their incense to power; and we are only too fortunate that in the case we refer to they have not set up an unworthy idol. Where the consequences of this act may stop it is impossible to say; but at any rate it is the duty of all true lovers of Science to protest at once against the attempt which has been made to place it under the disguised servitude of Royal patronage.

And whilst we are thus upon the subject of the relations between the Government and scientific men, we may as well observe that of late we have had occasion to examine a little into the assertions made by the Registrar-General with respect to the decrease in the mortality at Ely in consequence of the sanitary works there executed. Now, we beg, before dwelling upon the result of our inquiries, to state that the works in question are of themselves highly creditable to the public spirit of the town, and to the skill of the professional gentleman, Mr. Burns, who carried them out. They have been cheaply, and, on the main, successfully executed; nor do we for one moment question the benefit they must have conferred on the inhabitants, but we do most distinctly protest against the reasoning of the official scientific authorities from the returns of the mortality of the district subsequently to their completion. It appears that in 1849 the mortality of the town of Ely was at the rate of 23·95 per 1000, whilst in 1855 and 1856 it was reduced to as low as 17·23 and 17·21 per 1000. Of course this is very satisfactory, but when we seek to explain the causes of improvement, we must not allow our reason to be run away with by our theories. Now, it happens that in other towns of this district where no sanitary works (as it is the fashion to call certain descriptions of municipal operations) have been executed, the mortality has been proportionally decreased. If, for instance, we turn to Wisbeach, we find that the gross mortality of the year 1851 was, when calculated upon the population of that year, nearly at the rate of 28·13 per 1000; and if the population be only increased by the very rude approximation of the arithmetical annual mean, ascertained from the increase between 1841 and 1851, it would appear that the mortality was not much, if at all, above 18·56 per 1000 in 1856. Now, between 28·13 and 18·56 there is a greater range than there is between 23·95 and 17·21; so that, to our minds at least, it is far from being satisfactorily demonstrated that the influence of the sanitary works at Ely has been as great as has been asserted. The improvement in the sanitary conditions of the whole of this district has, indeed, been very distinctly marked of late years, and it is of the highest importance that the real causes which are there at work, should be clearly and philosophically ascertained. As we shall have occasion to observe, there are districts singularly like the Fens of East Anglia, which have a direct interest in this matter.

It really does seem surprising that the mere suppression of privies and cesspools, and the supply of a very indifferent water, in a town built upon what formerly was an island in the midst of a swamp, should have produced the remarkable results which are said to have taken place here. In such a situation it seems to us that the public health must depend far more upon the causes affecting the whole district, than it can depend on those immediately at work upon the dwellers in a town of such a very small area. Of late years it is notorious, in fact, that the steam drainage of the fens has enabled the proprietors of the land in that neighbourhood to keep the surface almost constantly dry, instead of leaving it, as of yore, alternately wet and dry during the winter months; and we have, moreover, during the seasons of 1856, '57, and '58, experienced a remarkable degree of drought. This permanent and this accidental condition must equally have had an influence upon the atmospheric state of the district; and we are strongly inclined to suspect that they have had far more to do with the improvement in the sanitary state of Ely, and of Wisbeach, than could be the case with respect to the small improvements effected in the former named town. One very important remark is, however, here to be made—namely, that the improvement in the rate of mortality of Ely bears the most distinctly upon the infantine

mortality; and it would thus seem that the removal of domestic nuisances, to whose injurious effects children must be the most directly exposed, has indeed done much of the good attributed to it. But it is also said that of late years the use of laudanum has declined amongst the Fen population; and it is notorious that the children of the poor were formerly plied with that fearful drug to a literally enormous extent.

The other districts we have referred to as having a direct interest in this matter are those of Zealand, Holland, Freisland, &c.; for, whilst we in England are able to discuss quietly how we may explain the improvement in the salubrity of particular towns in our marsh lands, they are suffering (as we learn from our correspondents) in a most fearful manner from ague, typhus, and typhoid fevers. The amount of suffering and loss from these sad diseases must be terrific if the accounts which have come to hand are strictly correct; nor do the evils arising from the unhealthiness of the districts seem to be confined to the human race, as the cattle of Friesland especially are said to be dying by thousands from pleuropneumonia. There cannot exist the shadow of a doubt with respect either to the cause or the remedy of this sad state of things. The whole of the drainage system of Holland is in a most unsatisfactory state, and the artificial means employed for removing the water are as barbarous, and as disgraceful to the engineers of that country, as it is possible to imagine. Steam-engines are rarely used, and the windmills are of the most primitive style of construction; the canals and drains in the cities are foul, stagnant, and dirty in the extreme, whilst the œdility of the towns is generally neglected in a shameful way, which can only be accounted for by the existence, and the powerful influence, of a strongly-organized system of State intervention in these matters. The Registrar-General very properly stigmatizes the apathy of the landed proprietors of the neighbourhood of Sheerness in carrying out the drainage of their property, but we wonder what he would say to the conduct of our neighbours? Yet they die at a fearful rate, and they allow their property to be wasted, without an effort to combat the evils under which they suffer. The mere money cost of the human suffering, and of the destruction of animal life in one year, would almost cover the outlay which would be required to introduce an improved system of drainage in Holland; and yet, because (perhaps) cursed with the highly-organized and scientific staff of the Waterstaat, every attempt to introduce change or improvement is resisted. It might interest those who in Holland are disposed to inquire into the matter, if we were to state here that in the best-regulated of our Fen districts, drained by steam power and with coals costing 17s. 6d. per ton, the cost of the drainage and embankment system does not exceed 3s. per acre per annum, when the areas dealt with are sufficiently large.

There have occurred two minor events connected with the engineering and physical history of the district at the *embouchure* of the Thames to which, in passing, it may be worth while to allude. The first is, that the well lately sunk for the water supply of Southend has at last passed through the blue clay into the basement beds of the London tertiary basin, at a depth from the surface of 415 feet. The second is, that a serious land-slip has occurred at Warden Point, in the Isle of Sheppy, which has carried away a somewhat "huge cantle" of that apparently doomed district. In fact, it seems to us that the whole of the hydrographical conditions of this part of our coast require to be very seriously examined; and that it is the duty of our Admiralty to take some decided steps in the matter. It would be possible, by consulting some really *eminent* Engineer, to co-ordinate the investigations with respect to the tides and currents of the estuaries of the Thames and of the Medway, with those required for the improvement of the sanitary conditions of the Port and Dockyard of Sheerness.

In one of the so-called American Journals we observe that an account is given of an Artesian boring lately executed at Louisville, Kentucky, to which attention may here be called, as illustrating either the carelessness of our Transatlantic brethren in their philosophical observations, or as indicating the existence of a very different law of the increase of temperature at great depths from the surface in America, from the one which prevails here. It is stated that the boring is carried to a depth of 2086 feet from the surface, and that the water rises at the temperature of 76½° Farenheit; but as the water from the Artesian boring of Grenelle, from a depth of about 1802 feet, rises with a temperature of 81·81°, we confess that for the present we regard the description of this Louisville well with some amount of suspicion. The work itself is a remarkable one, and it has only been exceeded in depth by two of the borings in the German saliferous formations. It appears that Mr. Bateman has made a communication to the British Association on the results of a boring he has lately executed in the new red sandstone, to which we may return hereafter, for the experiment at Rugby, and the daily increasing demand for the water supply of the town situated upon that formation, invest the subject with great interest.

At the Aberdeen Meeting it seems that the subject of the occurrence of flint axes, in association with the remains of extinct animals of the pachadermal and carnivorous tribes, to which we had before alluded, was brought prominently forward by Sir C. Lyell; and that he expressed his opinion very strongly in favour of the theory, derived from the simultaneous discovery of these remains, of the greater antiquity it is necessary to attribute to the existence of our race upon the globe than had hitherto been believed. Sir R. Murchison also showed that many of the usually received opinions with respect to the geology of the primary, or of the early secondary rocks, must be considerably modified, whilst the recent discovery of the fossils of the air-breathing conchiferœ in the coal measures teaches that, even with respect to them, geological science is only in a very crude and imperfect state. Art is very long—life is very short (and uncertain too, as the recent losses to the Engineering Profession only too plainly show); and at times it is almost disheartening to find that we have so much to unlearn of that which we have believed for years. Yet this seems to be a necessary condition of human knowledge, and progress is only to be attained by a ceaseless, earnest devotion to truth, and to the development of Science.

In another branch of physical science, as applied to the ordinary purposes of life, a rather curious observation has lately been made which may hereafter lead to discoveries in other fields of study. Thus, during the recent brilliant appearances of the Aurora Borealis, it has been noticed that serious disturbances of the electric telegraphs have taken place, and that the disturbance has borne a rude species of direct ratio to the length of the line itself. Possibly this observation may throw some light on the science of terrestial magnetism; and it may be even upon the sanitary influences of the electrical state of the atmosphere.

The *Saturday Review* has lately been rather facetious (in its heavy way) upon the "Geography of Dirt," in an article which might be commended to the attention of our continental neighbours, if they were not, as a rule, too stolid and too faithful to their love of Dirt for us to hope that mere argument would move them. At the same time our contemporary inserted an article on "Water rights," which might, and ought to have been, treated in a far deeper and more philosophical spirit than was exhibited on the occasion. It is unfortunate that in all which has been hitherto written on this subject, either the legislatorial or the scientific part of the question has been slurred over by the authors; and thus it happens that no broad philosophical principles have been adopted by the tribunals who have been called upon to decide the various questions hitherto litigated for the purpose of ascertaining water rights. The recent decisions of the House of Lords do not seem to have settled any principle, but merely to have asserted a supposed right which may be contested and interfered with in an infinite number of ways; and which may, in many cases, give rise to great wrong, and to much practical mischief. The subject is far too important for us to allow it to remain in public estimation as the author of the article in the *Saturday Review* has left it; or for us to treat of it in a subsidiary manner. We will therefore return to it on some future occasion.

## Circular to Gas Companies.

Our last impression contained a report from the Liverpool Watch Committee to the Town Council, wherein an interpretation is given to the 7th section of the "Act for Regulating Measures used in Sales of Gas," which is so much at variance with the whole spirit of the Act, and so incompatible with other sections, that we apprehend such interpretation cannot be maintained. It will be in the recollection of our readers that the Act gives the option to Town Councils in boroughs which are not manufacturers of gas, to appoint the inspectors in such boroughs; and in the event of their declining

to avail themselves of this option, the appointments are to be made by the County Justices. Upon this the Liverpool Watch Committee report that "the expenses of carrying out the Act are to be borne in counties out of the county rate, and in boroughs out of the lighting rate, or, if none, out of the borough fund; and all fees and penalties are to be applied in aid of the account on which the cost is chargeable. It is discretionary with Town Councils whether or not they will adopt the Act for their district. The power is to be exercised by them within six months, otherwise the statute will for ever afterwards have to be administered by the County Justices acting for the borough as well as the county, and they will have to make all the appointments, fix the number of inspectors, and regulate the pay at the expense of the borough lighting rate." We admit that this interpretation would be correct if the 7th section of the Act stood alone; but we apprehend that previous and subsequent sections limit the term "borough" in the sixth line of the section to "such boroughs as may adopt the Act." Were it otherwise, the provisions of the 8th section, by which the inspectors are bound to pay over all fees to the "justices, magistrates, town council, or other persons *by whom they may have been appointed*," would be unjust towards boroughs in which the Act is not adopted, as in such cases the lighting or borough rates would be chargeable with the expenses, while the fees went into the county funds, towards which the boroughs pay their quota; so that they would be paying the expenses of carrying out the Act twice over. It would, however, be as well to have a point so important settled by the Court of Queen's Bench during the next term, or before the period expires within which Town Councils have to elect whether they adopt the Act or leave it to be carried out by the County Justices.

There are symptoms of the commencement of an agitation with the view of inducing the Legislature to pass a general Act to authorize the appointment of public inspectors periodically to test the quality of the gas supplied throughout the kingdom. The matter was introduced by Mr. Dalglish, one of the members for Glasgow, at the meeting recently held in furtherance of Mr. Flintoff's schemes; and we have seen a circular on the same subject issued by the secretary of some unknown association in London for the remedy of all the grievances of gas consumers. We can only repeat the opinion we have already expressed on this question, that the practice of photometry is so contradictory and uncertain as to render practical legislation for the present impossible.

The statements made by the chairman of the Phœnix Gas Company at the last general meeting, with regard to the proportion of gas lost by leakage to the quantity made, and the proportion of coke used as fuel to that produced at their works, have attracted considerable attention, and our last publication contained an invitation from the engineer of one of the best managed and most prosperous of the London gas-works for some explanation, which has, however, not as yet elicited any reply. The statements were to the effect that, upon an assumed yield of 9000 feet of gas per ton of coal, the loss from leakage and all other causes amounted to only 7⅜ per cent., and that 15½ per cent. of the coke produced sufficed as fuel for heating the retorts. In other words, that 8336 feet of gas and 30·42 bushels of coke were brought to charge for each ton of coal carbonized. These figures indicate most able management on the part of the Company's officials, and we believe the misapprehensions entertained with respect to the statements of the chairman are due more to the manner in which they are put, than to any substantial error. It is admitted that the indicated yield of gas exceeded 9000 feet per ton, but the surplus is discarded from the calculation on the ground of the measurement having taken place at a high temperature. Supposing, however, that the indicated yield was 9250 feet per ton, the leakage would have been raised to 9·87 per cent.; and 9500 feet per ton would have raised it to 12¼ per cent. So, again, with the coke, the normal yield of which is assumed to be 36 bushels per ton of coal, but it is well known that many Newcastle coals will really yield 38 bushels, and some of them 40 bushels of coke per ton; and this correction would again raise the fuel account to 19·94 and 23·95 per cent. of the quantity produced. If A. B. C. will state the *quantity* of gas and of coke he brings to charge for each ton of coal carbonized, the difference between his workings and those of the Phœnix Company can be better appreciated.

Mr. Flintoff has been more successful in exciting a gas agitation in Glasgow than we anticipated he would have been among that usually keen-sighted and calculating community. To do that gentleman justice, he possesses great facility in dressing up an attractive case; and by bold assertions, not slavishly bound to truth, by skilfully mingling facts with fiction, and by an adroit suppression of circumstances not convenient to be known, he can contrive to present an alluring picture of what ought to be the conditions of gas supply in any given locality. With a perseverance worthy of a better cause he has managed to dissatisfy the gas consumers of Glasgow so far as to induce a number of them to sign a requisition for a public meeting to consider the propriety of adopting measures for cheapening the supply of gas. In another column will be found a full report of the proceedings of the meeting at which Mr. Flintoff enjoyed the privilege of abusing the established companies and of presenting his estimates for the formation of a new one to supply the city with gas for 3s. per 1000 feet, and leave the shareholders a profit of 10 per cent. on their capital. The value of Mr. Flintoff's estimates has been already practically experienced at Sheffield in so decided a manner that little more need be said of them than that, after magnificent promises to the consumers and the shareholders, founded on detailed estimates, the result of twenty-six months' working presented *a balance of positive loss* of £1596. 3s. 4d., and it became necessary to raise the price to consumers. Having thus proved the facility of making fallacious estimates for lighting a town similarly situated to Glasgow, it does not require much skill or labour to concoct estimates of equal validity for that city. Some of the items have been already questioned by parties on the spot, who are conversant with the manufacture of gas; and, without going into particulars, it may be safely asserted that the cost of suitable works would be more than double Mr. Flintoff's estimate, and that the manufacturing expenses and returns are equally misrepresented.

London continues to be Mr. Flintoff's chief model city for gas supply, and he persists in asserting that the 4s. gas has afforded the shareholders of the Great Central Company 7½ and 10 per cent., though he must be well aware that the dividends were originated by the losses of their contractors, and that the company were compelled to pay nearly £15,000 to their first contractor to compensate him for extra expenses in manufacturing gas, which sum will have to be paid out of future profits, and that his successors in the contract have been obliged to take refuge in the *Gazette*. Though thus reiterating his misrepresentations respecting the supply of gas to the metropolis, Mr. Flintoff carefully abstains from noticing the fact of which we reminded him—that cannel gas of an inferior quality to that supplied in Glasgow is charged in London 6s. the 1000 feet. London is a model city in those parts where it is supplied with 12-candle gas for 4s.; but those portions where gas nearly corresponding in quality to that supplied in Glasgow is charged 1s. per 1000 more than is paid by the aggrieved consumers of the latter city, are conveniently kept out of sight.

The condition of gas supply in the highly-favoured town of Liverpool is much more aptly adduced by Mr. Flintoff as an example for imitation, and inasmuch as the United Liverpool Gas Company share 10 per cent. whilst they supply cannel gas for 3s. 9d., the citizens of Glasgow may have some reason to inquire why they are charged 5s. But there are many circumstances which give advantages to the Liverpool Gas Company that are not possessed by others; and though that town is indeed a model in its gas supply, there are few places that are in a position to equal it. The supply of a large densely-populated town by a single company is one of the great advantages which the Liverpool Gas Company possess, and the best course the citizens of Glasgow could adopt with a view to rivalling that model town would be to concentrate the supply in one company instead of rendering the participation in such advantages impossible by the formation of another. If there be any grievance to complain of the gas consumers of Glasgow have the remedy in their own hands, for the two companies established there are placed under the Gas-Works Clauses Act, and the enforcement of a rigid compliance with that Act would give them all that could be reasonably required. It was by the operation of that Act that the gas consumers of Liverpool obtained a reduction of price to 3s. 9d., and if efficient auditors of the accounts be appointed, the limitation of dividends to 10 per cent., and the appropriation of the surplus to a reduction of the price, are the best

guarantees that gas consumers can possess of being satisfactorily supplied. The formation of a competing company for reducing the price of gas has been tried again and again without success, and there is nothing in Mr. Flintoff's antecedents to render it probable that such an attempt would be more prosperous under his auspices.

## Communicated Articles.

### HYDROLOGICAL CHEMISTRY.

THIRD NOTICE.

The fourth part of M. Lefort's treatise is devoted to the examination of the methods of analysis of fresh and of mineral waters. Before, however, entering upon the investigation of the methods of analysis hitherto suggested, M. Lefort gives, in a very practical form, a description of the precautions which must be observed in the collection of the samples to be operated upon, and which it is absolutely essential to observe if correctness of analysis be desired. The precautions are according to the nature of the waters:

For soft waters, if obtained in the form of snow or of ice, to melt them, gradually, in a room whose temperature does not exceed that of the melting point (32° Far.) in any marked degree. Immediately after its liquefaction, the water so obtained must be filtered, in order to remove the extraneous matters it usually contains. The oxygen and the nitrous acid gases the water may contain are then removed, and the quantitative and qualitative analyses are conducted in the manner usually adopted in the analysis of other waters. In the case of the analysis of soft waters obtained from springs or wells, that operation consists of two parts, one to be effected on the ground, and the other in the laboratory. Upon the ground, for instance, it is advisable to ascertain the temperature of the water, the geological nature of the rock from which it flows, its physical properties, and its reaction upon the principal tests. The separation of the various gases, acids, bases, salts, &c., can only be effected in the laboratory, but it must be done as soon as possible after the sample has been obtained. M. Lefort includes also, amongst the indispensable operations to be performed on the ground, the determination both of the sulphates of the water under examination, by means of the sulphuromètre and of the fixed and free air present; and he insists upon fixing the carbonic and the hydro-sulphuric acids, whether free or combined, by means of the ammoniacal chloride of barium and the ammoniacal nitrate of silver; the qualitative analysis, according to our author, ought likewise to be performed upon the spot, for if the waters should otherwise be transported to a great distance, serious causes of error may be introduced. M. O. Henry (one of the most distinguished Hydrological Chemists of France) has drawn up a series of instructions as to the manner of obtaining samples of water, which is here inserted for the guidance of English municipal authorities who may have occasion to undertake investigations of this nature.

1. It is desirable that the samples should be taken by, or in the presence of, some responsible authority, and that he should certify to their genuine character. They should be obtained in fine weather and in the dry season, if an *average* composition be only sought for; and if the waters should contain much gas, they should be taken in the morning rather than in the heat of the day. Observations should be made as to the geological nature of the source, and to the organisms found in the streams or pools, if the analytical chemist himself should not be present.

2. A quantity of from 15 to 20 litres (3½ to 4½ gallons) should be taken, and if there should be more than one spring, about 10 litres (2½ gallons) from each of them should be sent. The waters should be received into glass or stoneware vessels, properly cleaned, and washed out in the springs themselves; the corks used must be new, and it would be desirable to soak them for three or four days in the spring before using them. If possible the samples should be obtained by holding the bottles in a reversed position, and with the opening a few inches below the surface; then the bottle should be quickly brought into its natural position, and corked under the surface of the water. Care must be taken not to disturb the mud at the bottom of the spring, or to disturb the waters in such a manner as to interfere with their natural limpidity. In the case of warm mineral waters, it is necessary to observe some special precautions with respect to the mode of corking the bottle, in order to obviate any inconvenience from the temperature of the springs. If the waters should be sulphureous, the bottle must be filled as perfectly as may be, in order to leave as little air as possible in it; if the waters should be ferruginous, it is essential that the bottles should be opaque, for light is able to produce marked changes in this class of liquids, and the bottles should be carefully filled; if the waters should be alkaline and gaseous or acidulated, the cork should not be inserted for a day or two, and when it is placed it must be kept down by a wire or by a metal cap; the ordinary saline waters require no particular care, but in all cases the corks must be rendered impermeable by covering them with sealing-wax or some such substance.

3. It is often desirable to forward with the samples of water some of the organic or inorganic matters which grow in it or are precipitated from it, care, of course, being taken to eliminate any possible source of error. For instance, the confervæ, or the scum floating upon the surface of the spring, or the ferruginous or calcareous deposit upon its bed, may furnish valuable indications of the composition of the water itself; and at the same time, if the party selecting the sample should not be able to give a correct geological description of the rocks from which the water flows, specimens of them should be sent. Moreover, as it is often necessary to ascertain the proportions of certain very volatile principles, such as those with a sulphur base, it would be advisable to add to two or three bottles about two grammes of the crystallized nitrate of silver: these bottles must be specially labelled. M. Dupasquier's test for ascertaining the presence of sulphuretted hydrogen should likewise be applied at several periods of the day, and the results transmitted with the other documents to the chemist charged with the analysis. The samples should be sent to him as soon as possible after being taken, especially in the case of the mineral waters in which chemical changes may take place.

In the description which M. Lefort gives of the method of chemical qualitative analysis to be adopted in the examination of soft waters, he begins by stating the results observed when the ordinary reagents are applied, somewhat as follows:—When test-papers died blue by a solution of sunflower water (*query* litmus paper?) are plunged into a river or spring water, they may be observed to assume a red, vinous colour, if any free acid should be present, such as the carbonic acid; but it is impossible to identify the specific nature of the change, or of the acid producing it, because several extraneous substances are able to produce this same result. If, however, the waters should contain the bicarbonates, and the said waters were boiled, it would be found that the test-papers which had thus passed from blue to red would, when immersed in them, return to their original blue colour. If test-papers, soaked in the acetate of lead, be immersed in ordinary waters fitted for household purposes, they will not change colour unless the waters should be partially decomposed, in which case the papers will assume a yellowish or a brown tint. This change may, in almost all cases, be attributed to the presence of sulphur or of the sulphuretted hydrogen.

Alcohol poured into spring waters only affects them when there is present a remarkable proportion of the sulphate of lime. A solution of galls or of bark does not produce any marked change in the commencement; but, if those reagents should be left in contact for any length of time with the ordinary waters, the latter would infallibly become turbid, and assume a light, dirty green tint; the gallate and the tanate of iron would, in fact, be formed, and they would colour the waters; if a considerable quantity of iron were present, the colour would pass to a brownish violet. The alcoholic solution of soap occasions a degree of turbidity, and occasionally gives rise to a white curdled precipitate, which collects upon the surface of the water, according to the quantities of lime or of magnesia the waters under examination may contain; but M. Dupasquier observed that the bicarbonate of lime did not combine with the acids of the ordinary solutions of soap to form with them the insoluble soaps above described. Dr. Clark in our own country, and Messrs. Boutron and Boudet in France, have applied this soap test to ascertaining the relative degrees of hardness of waters with considerable success.

M. Dupasquier suggested, as a test of the presence of slight traces of the bicarbonate of lime, the application of an alcoholic solution of dye-wood (campeachy) which is known to communicate a reddish yellow tint to distilled waters, but, when the bicarbonate of lime is present, the colour passes through a yellowish red to crimson and to dark violet. This test, however, is, according to Dupasquier, only applicable when the bicarbonates of potassa or of soda are absent; and it therefore becomes necessary, before applying it, to ascertain whether either of those salts be present, by testing for the various bicarbonates with the sulphate of copper and the chloride of calcium. M. Lefort does not seem to attach much value to this test, and, indeed, he only includes it in the series of rough approximations to truth which may occasionally be employed in preliminary investigations, out of respect for its author.

The solutions of potash, soda, and ammonia produce, when mixed with soft water, phenomœna which are precisely analagous; that is to say, that when added in smaller quantities they cause the water to become cloudy; and when their quantity is increased a deposit is formed, consisting of the carbonate of lime and magnesia. Lime water and a solution of baryta give rise to deposits of variable importance, according to the composition of the waters, with respect to which the most important remark to be made is, that when the waters contain the sulphates of lime, the precipitate is thrown down immediately, and is principally composed of the sulphate of baryta. The introduction of the mineral acids, such as the nitric, sulphuric, and the hydro-chloric acid, produces but a very slight reaction in the waters to which they are applied, whilst the oxalic acid affects the limpidity of the waters in proportion to the quantity of lime they may contain, and the tartaric acid scarcely produces any perceptible effects. The chloride of baryta almost always produces a cloudiness in soft waters, and it gives rise to a precipitate composed of the carbonate or of the sulphate

of baryta which would become more distinct if the mixture should be boiled. The addition of an ammoniacal chloride of baryta gives rise at once, and in every description of water, to a copious white deposit, consisting of the carbonate, phosphate, and sulphate of baryta; and it is by the use of this test that M. Lefort, and the French chemists generally, ascertain the quantity of free and combined carbonic acid disseminated in the soft or in the mineral waters under examination.

Very little effect is said to be produced by the application of the following tests to waters possessing the usual qualities of household waters—viz., the chlorides of calcium, gold, or platinum, the yellow or red cyanurates, the carbonates of potash or of soda, or the sulphate of soda. The sulphate of copper and the phosphate of soda produce a slight reaction; and the ammoniacal phosphate of soda produces an effect analagous to that of the alkalis. M. Lefort attaches, however, the most importance to the use of the silicate of potash as a test of the qualities of a water intended to be used for drinking purposes, and he claims the credit of having been the first person to suggest its use. M. Lefort says that when the silicate of potash is first applied to a water, like that of the well of Grenelle, or of the Seine, for instance, it does not produce any perceptible effect; but that after ten minutes or a quarter of an hour the liquid will become slightly opalescent. The silicate of potash, in fact, causes a cloudiness of the waters proportionate to the quantity of the carbonate of lime they may contain, when that salt is the characteristic one present; but when the nitrates or sulphates are present in notable proportions, the deposit becomes greatly increased.

M. Lefort describes, also, in detail the effects produced upon the ordinary tests by the reactions of the bicarbonated, sulphuretted, chloritic, and ferruginous mineral waters. It would be impossible here to notice his observations with the attention and at the length that they deserve, and therefore we prefer to refer our readers to the work itself, observing simply that, amongst the tests proposed, the ones which seem to us to be the most worthy of study are the silicate of potash and the various salts of cadmium and barium, perhaps more on account of their novelty than on account of any indications hitherto furnished by them. The analysis of these mineral waters, it may be added, constitutes a branch of chemistry of the very highest and most abstruse description; and we should prefer waiting until some of M. Lefort's experiments have been confirmed by other observers before admitting them implicitly. The observations made by M. Lefort himself upon the "sulfhydromètre" of M. Dupasquier shows that there is still very great reason to exercise caution before arriving at any absolute conclusions in investigations so delicate and so liable to error. One serious objection, moreover, may, we believe, be made to the conclusions which would be drawn from any detached analysis, even when conducted with all the precautions, and in all the detail suggested by our author, which is, that they would, after all, only represent the qualities of the waters at the moment they are taken. M. Lefort, and, indeed, most hydrological chemists, overlook the fact that spring, lake, or river waters may vary in their composition from hour to hour; and it is, therefore, necessary to add to all the instructions hitherto issued with respect to the collection of samples and to their analysis, that the waters, with respect to which an opinion is required, should be examined at least at every marked atmospheric change of a nature likely to affect their sources of supply. The precautions suggested by M. Lefort to ascertain the temperature and the density of the waters to be operated upon, are so simple that they may be passed over.

In the portion of M. Lefort's book devoted to the examination of the methods of quantitative analysis most generally adopted in France, the sections which seem to us to be the most worthy of notice are those in which he describes the methods for ascertaining the proportions of the salts of iodine and bromine, and for dosing the organic matters the waters may contain. Our official chemists would do well to study this last portion of their own science; for they usually content themselves by stating that such or such waters contain such or such quantities of organic matters, without giving any indication of the specific nature of the several ingredients. Yet, in addition to the soluble organic matter which may be present, it is known that there may be one or other of the following long list of acids, arising from or contained in the organic matter itself—viz, the crenic, apocrenic, acetic, formic, propionic, and butyric acids, together with appreciable quantities of bitumen. Surely it must be nearly as essential to know the composition of the organic matter, as it is to know the precise quantity which is contained in a water; especially when the last-named quantity is made the ground for approving or disapproving a source of water supply. M. Lefort, we may add, terminates the portion of his book in which he treats this question of the analysis of the organic matters in water by the following remarks, worthy of the attention of Dr. R. D. Thomson especially. "Whatever be the nature of the re-agent employed," says M. Lefort, "it is not possible in the present state of the science to ascertain even in an approximate manner the quantities of organic matters, whether nitrogenous or not, which are dissolved in soft or in mineral waters."

One of the remaining chapters of M. Lefort's interesting volume is devoted to a description of MM. Boutron and Boudet's method of determining the quantities of the salts of lime and magnesia contained in a soft water. This method, notwithstanding the seeming candour with which Dr. Clark's investigations are referred to, must, in our opinion, be considered to be a rather barefaced plagiarism of the inventions of the latter able chemist. Indeed, it may be urged as a very serious objection to the value of M. Lefort's work—so far, at least, as it assumes to represent the present state of Hydrological Chemistry as a science—that he, in common with the bulk of his countrymen, seems to be perfectly ignorant of everything which has been done in other countries than his own, or which has been written in languages foreign to him. The researches of Mr. Spencer, those of Messrs. Way, Hofmann, Letheby, Odling, Witt, Clark, A. Smith, Medlock, &c., might unquestionably have furnished at least matter for discussion; and even the mischievous theories of our late General Board of Health seem to us to have required examination in a book especially devoted to a review of the whole science it was intended to discuss. But Frenchmen of the present day—like the Greeks of old or the Chinese of our own times—seem to regard other nations as "barbarians," and, as such, to be beneath notice. The consequence is, that their own science is often incomplete, and they as often shut from themselves glimpses of knowledge which might save them much time and advance them greatly in their pursuit of truth. Nevertheless, with this defect even, the work of M. Lefort seems to us to be one of the most able and conscientious essays it has been our lot yet to peruse upon a subject of great scientific and commercial interest, and as such we recommend it strongly to the attention of our readers—and of the translators of scientific books.

There are some short chapters illustrating the methods of analysis recommended by M. Lefort, and the methods of preparing the various tests he employs, to which attention has not been called in the above notice. They are, however, far from being without importance, and as such we refer to them before closing our remarks on the book before us.

We may add that our author has lately published a small volume, under the title of "*Chimie des Couleurs*," in which he has very ably discussed the history, and the physical and chemical qualities of the colours used by ancient, or by modern, painters in the fine arts, whether in the shape of oil or of water colours. At the present day, when so much is being said with respect to the action of gas lighting upon pictures, it might be of interest to compare M. Lefort's observations with those of other inquirers into the subject.

## Correspondence.

### COMPENSATING GAS-METERS.

Sir,—In the last number of the Journal of Gas Lighting, page 495, I observe a letter from Mr. C. R. Mead on the subject of compensating gas-meters. He states in the beginning, there are one or two errors in the impartial notice you have been pleased to take (in a former number) of his commendable endeavours to render the gas-meter a more perfect measuring instrument. I naturally looked for an allusion to those errors, and for his answers to them; but though I have read the letter over several times very carefully, I cannot trace from his remarks what the errors are into which he says you have fallen, for, instead of enlightening your readers on those points, he launches out into a broader and wider field, and attacks the compensating meters which have been introduced by other manufacturers, and then winds up with the gist of his letter, which like that in the PS. of a lady's letter, comes at last—viz., that his compensating meter is the only perfect one, and that every other which performs its functions by mechanical means must be borrowed from him.

I have in my possession one of Mr. Mead's reciprocating spoon meters, which I have submitted to the ordinary tests, and I find that, do what I will, it fails to perform those functions for which compensating meters have been introduced; for instance, the spoon elevator only dips into the surplus reservoir once for every revolution of the upright spindle (or for 5 feet of gas passed through the meter), which is equal to once for about 27 revolutions of the measuring-wheel. The motion is so slow, the quantity of water raised is so trifling, (only probably about one large drop,) the capillary attraction so great, (even when clean,) and the inclination of the spoon is so slight, that after being at the pains to arrive at the point where it should deliver the charge into the water-line reservoir, the spoon refuses to part with its drop of water, but takes it back again into the reservoir from whence it came, and so I have found it to act time after time; how much more likely will it be to do so when foul and working with three lights or less? This clearly proves that the open spoon acting reciprocally is a decided mistake; while, on the other hand, the hollow rotating arms of Crosley and Goldsmith's meter carry the water forward and discharge it every time they revolve through their hollow axis in a most efficient manner; and therefore I say that there is a wide difference between the two meters. I can quite understand Mr. Mead's disappointment that he did not hit upon the right thing while he was about it, but we have no reason to blame him for that, any more than the original inventor of the gas-meter

is blameable for not having introduced the meter in the most approved state, in which it may be found at the present date. On the contrary, credit is due to each of them for their inventions and ideas, which have led others on, as the improvements of the present day may, ere long, have to give way to those of a later date.

With regard to Mr. Mead's remarks about the speed and quantity of water raised, I totally dissent from his theory about infinitesimal doses being all that the elevators ought to lift into the water-line reservoir; in proof of which, I may mention that my firm has increased the sizes of the water-elevating arms, with the view of discharging an *increased* quantity into the water-line reservoir,—while according to Mr. Mead's last design, he has been *reducing* the possible supply from the small quantity that could, under the most favourable circumstances, be obtained effectively. Seeing that our meter is a low-spouted one, the surplus quantity poured in can do no harm, as it runs back into the surplus reservoir as fast as it is supplied (minus only the amount due to evaporation), but insures that, when it is wanted, there it is; whereas the infinitesimal dose system may and often does fail to do what it professes when required, and in such case it is virtually only equal to an ordinary non-compensating meter.

With regard to the extra pressure required to work the rotating compensators of Messrs. Crosley and Goldsmith, with their large arms and sufficient supply of water, as compared with the single spoon reciprocating action of Mead, Scholefield, and Wright—or even compared with non-compensating meters—it is simply absurd to raise the question in a practical point of view, because the difference is so slight, if any, as to be scarcely appreciable by ordinary pressure-gauges. It may suit the object of interested or prejudiced persons to raise a doubt on that subject, but that doubt may be as easily dispelled, if only put honestly to the test.

I should not have troubled you with this letter had Mr. Mead confined himself to simply giving a description of his own meter; but when he introduces my name and that of my co-patentee, I do not hesitate at once to say that his theory is decidedly wrong, as practice will ultimately prove, especially if his meters are worked at high and varying speeds,—which will have the effect of altering his water-line, while the slow action of his spoon compensator will not, in ordinary cases, restore the equilibrium during the general hours of lighting.

I notice also that he does not like the two bent arms in the rotating elevator; he prefers his "only one scoop." In that also I totally dissent from him, not only for the reasons already stated, but also because they are so placed that they balance each other in any position, and consequently do not cause any unsteadiness to the lights, which "the only scoop" principle is apt to do, from the irregularity of the leverage, and the consequent irregularity of the work which the measuring-wheel has to perform.

I do not know what the representatives of Mr. Scholefield and of Mr. Wright may think about the allusions to their names, but, unless Mr. Mead has more solid foundations for his remarks in those cases than in the first firm he selects for his onslaught, he should be more careful to be in the right himself before he commences his attacks on his brother manufacturers. I do not say this in any ill feeling, because I think open discussion and mutual interchange of ideas on such subjects lead to improvement; and we are therefore indebted to you for affording us the opportunity of discussing the merits of new inventions through your valuable JOURNAL, but it would be as well if your correspondents confined themselves to facts.

W. CROSLEY.

103, *Southwark Bridge Road, Sept.*, 1859.

## LEAKAGE AND FUEL ACCOUNTS.

SIR,—Your correspondent, A. B. C., complains of the want of correct data on which to calculate the per centage of fuel and leakage. It seems to me that it need not be a very complex question.

When fuel consists of coke only, the calculation is very simple. Allow one ton of coals to produce one chaldron of coke; ascertain the quantity of coke left for sale per ton of coals used, and the remainder must have been used for fuel—the per centage of which can be worked out by any junior clerk. When tar is used as fuel, test the quantity of tar burnt, fix its local commercial value, compare that value with the selling price of coke, and therefrom assume the additional quantity of coke which would have been used as fuel if no tar had been burnt: ascertain the per centage as before.

I will admit that a correct comparison of leakage has been much complicated by gas managers, owing, as your correspondent says, to the discrepancy among us as to the quantity of gas made per ton of coal. It has always been my practice not to look so much upon the quantity made per ton as to the *quantity of gas brought into charge*.

In some works the gas is passed through the station-meter in a heated state—in other works it is well cooled; a difference of 1000 to 2000 feet per ton may thus be accounted for, which will, of course, make a corresponding difference in the per centage of leakage; but, if the gas registered at consumers' meters and the quantity contracted to be burned in the public lights is ascertained, and divided by the quantity of coals used, a net yield per ton will be found which may bear comparison between gas-works having no station-meter, or with works having a station-meter in close proximity to the retorts, or at such a distance that the temperature of the gas in the station-meter is reduced to the temperature of the gas in the mains.

It will be found that the gas sold from a ton of Newcastle coals varies from 7000 to 8500 feet, according to the season of the year, and the management both internal and out of doors—the quantity being, of course, greater in winter than in summer.

If this principle were adopted comparisons might be much more effectually made than by the present uncertain calculation of per centage of leakage.

R. H. JONES.

*Dover, Sept.* 16, 1859.

## THE CARBON GAS FIRE.

SIR,—Several patents have been taken out for the materials used in gas fires in open grates, such as "pumice," "asbestos," the material called the "Polytechnic fire," "lump asbestos," and others, the use of which is very limited, in consequence of the expense. The "lump asbestos" is valued at a guinea a pound, and the "Polytechnic fire" material, although not so expensive in itself, requires more gas to raise it to a red heat; it also becomes very brittle by use, so that, when taken out of the grate to clean the gas-pipes (the holes requiring broaching occasionally), it breaks in pieces, and fails to produce the effect intended.

Finding this to be the case, and yet anxious to introduce gas fires, I have been trying experiments with various materials, and have succeeded in producing a gas fire superior, I believe, to any yet introduced. I have taken out no patent for it, so that all gas companies whose interest it is to introduce gas fires to the public may do so at the cheapest possible rate. The material I find best suited for use is the carbon—which is removed by the process called "scurfing"—from the interior of gas retorts; it should be broken up in lumps of about two and a half or three cubic inches, and piled in the grate by hand, not thrown on in a mass. I find this material causes a perfect combustion of the gas, makes an excellent fire, and throws out a great heat, with a less consumption of gas than any other material.

Gas companies can sell the carbon at 2s. 6d. per bushel, ready broken, so that the cost of material will be trifling, as one bushel lasts from three to six months, according to the heat required.

MAGNUS OHREN, A.I.C.E.

*Gas-Works, Sydenham, Kent, S.E., Sept.* 19, 1859.

## PRESSURE REGISTERS.

SIR,—I beg to offer a few remarks upon an instrument which, though of less commercial importance than the gas-meter, is certainly not less to be admired for the beauty and simplicity of its mechanical arrangements and for the infallible record it keeps of its daily work—I refer to the gas-pressure register, a simple instrument, and yet, from the way in which this has been described by Clegg, Hughes, and others, the principles upon which it is constructed must be an enigma to those whose knowledge is wholly derived from such books.

In describing the pressure register Mr. Clegg says:—

A small gasholder, about twelve inches in diameter, is made to move in a tank of water in such a manner that it shall rise or fall with the pressure in the mains, with which it is connected by a small pipe; a guide-rod, furnished on the top with a pencil, marks the exact amount of pressure upon a sheet of paper coiled round a cylinder. This cylinder is moved round once in twelve hours by a time-piece. It is evident, therefore, that if the paper be divided by horizontal lines, corresponding to the rise or fall of the gasholder by every tenth of an inch increase or decrease of pressure, and if it be divided by vertical lines, corresponding to the revolution of the time-piece in twelve hours, it will effect the object required. *The gasholder must be formed with an air-tight vessel inside, so that when it is totally immersed it shall be in exact equilibrium with the external atmosphere, and when risen to its full height it shall have a pressure equal to that required to force the gas through the mains—say the height to which the gasholder rises is equal to ten inches, and the pressure required three inches; then, if the paper be divided into thirty parts by horizontal lines, each division will indicate one-tenth of an inch.*

Mr. Hughes will not be found to be more instructive than his predecessor. He says:—

There are two kinds of *pressure gauges* (registers?)—namely, one on which the record is made on a sheet of paper revolving on a vertical axis, and the other made on a sheet revolving on horizontal axis. The pressure gauge, which recoils on a vertical sheet, consists of an inner and outer cylinder, so contrived that the *latter* is immersed with its mouth downwards in the water of the former. A pipe leads from the main into the outer cylinder and passes up through the water so as to admit the gas into the space enclosed between the water and the inner cylinder. This inner cylinder is so adjusted as just to float with its top in contact with the surface of the water when no communication is open with the main. When the gas is admitted, however, its pressure causes the inner cylinder to rise. * * * * * The other instrument for recording the pressure consists of an outer cylinder or tank, which is entirely closed in, except that there are holes in the bottom to allow the water in it to communicate with the water in an inner cylinder open at top; a float, to which is attached a rod carrying a pencil, rises and falls in this cylinder according to the rise or fall of the water in it—that is, according to the pressure of the gas in the outer cylinder; the pencil marks the pressure upon a circular sheet of white paper with radiating lines which indicate the hours, and concentric circles denoting inches and tenths of inches. The disc, on which the sheet of paper is placed, is moved by clock-work as in

the other case, and revolves once in twenty-four hours, at which interval a new sheet of paper must be substituted.

As the most obvious distinction between these two instruments consists in the manner by which motion is given to the paper upon which the register is made, the first receiving motion from a vertical shaft, and the other from a horizontal spindle, they may then be distinguished as the vertical and horizontal machines. The latter is only a modification of the former, but as it perhaps cannot be so readily understood as the other, I will refer to it first as the consideration of its action will clear the way for what has to be said upon the vertical instrument.

The principle upon which the horizontal machine is constructed is nothing more than the adaptation of a float to a pressure-gauge for the purpose of recording, by means of a pencil attached to the float, the rise and fall of the water in one column of the gauge, when subjected to varying pressures, the same being registered upon a paper graduated to inches and tenths of inches in one direction and into hours in the contrary direction, fixed upon a disc which revolves once in twenty-four hours. Thus, if in an ordinary pressure-gauge a small float be placed on the surface of the water exposed to the air, and the gas be turned on into the other leg of the gauge, the water in this tube will be depressed to half the extent of the pressure, and the water in the other leg, with the float upon it, will be raised to the like extent, if the tube be of the same diameter throughout. If, however, the two legs vary in diameter, the space passed through by the water in each tube will vary, but the distance between the two surfaces will still be the same for the same amount of pressure, and the same volume will be displaced in each tube. The space passed through by the fluid in each tube will be inversely as their sectional areas, the volume displaced in each being equal. For example: If one tube is two square inches in area, and the other is ten inches, then the space passed through by the water in the small tube will be five times that passed through by the water in the larger tube for any given pressure. To prove that the volume is the same in both tubes, multiply the space passed through by the bore of the tube, which will be in this case

$$5 \times 2 = 10 = 1 \times 10 = 10,$$

the volume displaced in both tubes. Again, as the pressure of a column of water is as its height multiplied by its base, we see by the above that the pressure of each column of fluid in the gauge is equal.

Mr. Hughes is not much more intelligible in describing the horizontal machine than the vertical when he says "the instrument consists of an outer cylinder or tank, which is entirely closed in, except that there are holes in the bottom to allow the water to communicate with an inner cylinder, open at top;" nor does an engraving of the machine assist the reader in the matter. The "outer and inner cylinders," as Mr. Hughes calls them, form an annular chamber, the external ring of which is attached to the bottom of the instrument, and forms a vessel for containing water; the top of this ring is attached to the inner ring so that the two form a gas-tight chamber when sufficient water is in the vessel to seal the openings round the lower part of the inner ring, which are for the purpose of allowing the water to flow to and from the annular chamber and the space encircled by the inner ring, which is open to the atmosphere. The action may be thus described: Gas being admitted into the space above the water in the annular chamber, the water in it will be depressed by the pressure and forced through the openings in the inner ring and up into the space encircled by it, the distance between the two surfaces indicating the pressure. Then, if the area of the water exposed to the pressure of the gas in the annular chamber be equal to the area of the water open to the air within the inner ring, the depression of the one will be equal to the elevation of the other, just as in the pressure-gauge. And so, if the area of the water exposed to the action of the atmosphere and the pressure of the gas be unequal, the rise and fall will be unequal; but, as the distances will be inversely as the areas, the same volume will rise as fall, and the pressure of each the same—the distance between the two surfaces being the pressure of the gas. Hence it will be seen that the range of the registering-scale will be limited by the actual pressure of the gas unless a mechanical arrangement is interposed between it and the float on the water in the inner ring, to which float the pencil is attached. In other words, the space passed through by the recording pencil must be less than the height of a column of water equal to the pressure of the gas upon the machine. For example: If the pressure be one inch, and the pencil will not pass through one inch of space, the volume depressed and raised must be equal to each other, and the two volumes must be equal to the pressure.

Of the vertical machine the writer of a paper in an American periodical says:—

> A great advantage possessed by this instrument over the ordinary pressure-gauge is in the enlargement of the scale. The pencil can be made to traverse several inches of paper scale by an actual variation of only one inch pressure, and, as a consequence, variations, which would escape the eye upon the ordinary water-gauge, become quite evident when thus magnified two or three times. The scale is determined by the proportionate diameters of the holder and float within. Upon the admission of the pressure to the holder it rises, carrying with it the float, until the loss of buoyancy, by the withdrawal of the float from the water, becomes equal to the pressure of the gas upon the annular area of the holder. Thus, by diminishing or increasing the diameter of the float, the scale may be lengthened or shortened at pleasure. For example: Suppose the gasholder to be twelve inches in diameter and the float six inches in dameter. In this case the area of the float would be one-third of the area of the annulus remaining exposed to the pressure of the gas in the street mains; and, consequently, the holder would rise three inches for a pressure of one inch of water in the street mains, and require the tenths of an inch upon the scale to be really three-tenths of an inch.

This description throws a little more light upon the subject under consideration than either Clegg or Hughes, but very little. The writer says: "The scale is determined by the proportionate diameters of the holder and float within," and that "by diminishing or increasing the diameter of the float, the scale may be lengthened or shortened at pleasure"—and this is all. How "the scale is determined by the diameters of the holder and float," and whether the float has to be diminished or increased to lengthen the scale, and *vice versâ*, the reader is left as much in the dark as the reader of Clegg or Hughes upon the same subject. It is true he illustrates his subject by an "example." He says: "Suppose the gasholder to be twelve inches in diameter and the float six inches in diameter. In this case the area of the float would be one-third of the area of the annulus remaining exposed to the gas in the street mains; and, *consequently*, (why?) the holder would rise three inches for a pressure of one inch of water in the street mains;" and so of Clegg. He writes: "say the height to which the gasholder rises is equal to ten inches, and the pressure required three inches; then, if the paper be divided into thirty parts by horizontal lines, each division will indicate one-tenth of an inch."

Bearing in mind that the volume of water depressed in one column of a pressure-gauge is equal to that raised in the other, and that the space passed through by each volume is inversely as the sectional area of the column, let us apply this to the examination of the vertical machine as shown at fig. 1.

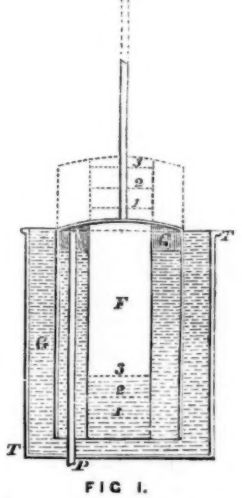


FIG 1.

T T is the tank; G G the gasholder; F the float; P the pipe to admit the gas into the holder, G G. Let it be supposed that the gas is just turned on, and that the pressure is one inch, as shown by the difference in height of the water in I and G. The float having displaced a bulk of water equal in weight to itself and the holder, is in equilibrium with the water, and will move as freely as it; consequently, as the gas is supposed to be just turned on, the gasholder commences to rise, and will continue its upward movement till its downward pressure—from increase of weight, through loss of buoyancy by rising from the water—is equal to the upward pressure of the gas in the holder. Now, as action and reaction are equal, the downward pressure upon the surface of the water within G G, will be equal to the upward pressure of the gas under G G, which, in this case, being one inch, the water is depressed to this extent. Then, as this volume is depressed, an equal one must be elevated; and if we consider the water so depressed to be one column of a pressure-gauge, and the other column to be the float, we have only to divide the volume so depressed by the area of the float to ascertain the distance the holder will rise from the water for any given pressure. Or, as the area of the float is to the area of the water, so is the pressure to the rise of the holder. For example: The holder as above is supposed to be six inches square, and the float three inches square; then $3\times3-9$, and $6\times6=36-9$, the area of the float, gives 27 inches for the area of the water exposed to the pressure of the gas in the holder G G, and if the pressure of the gas be one inch, we have the following:—As 9 : 27 :: 1 : 3, which gives us three inches for the height to which the float will rise from the water. Then the distance passed through by the float, multiplied by its area, will give its cubical contents, or the volume raised—thus: $3\times9=27=1\times27=$ the area of the water multiplied by the pressure by which it is depressed; or again, if the pressure be two inches, 9 : 27 :: 2 : 6, the rise in this instance will be six inches; and then, $6\times9=54=2\times27=54$. The volume in both examples of the water depressed and elevated

is thus shown to be equal. In each case the water on the outside of the gasholder has not been alluded to, as it is not affected by the action of the holder: the difference, as we have seen, between the heights of the two surfaces of the water in the inside and outside of the holder is the pressure of the gas. When the instrument is out of action, the two surfaces are, of course, of the same level; and when the pressure is on, as the water displaced is equal in bulk or volume to that part of the float raised from the water, the water occupies the space previously filled by the float.

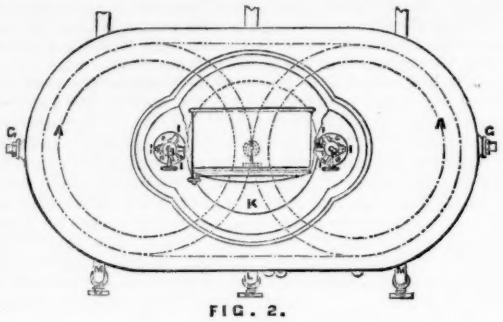


FIG. 2.

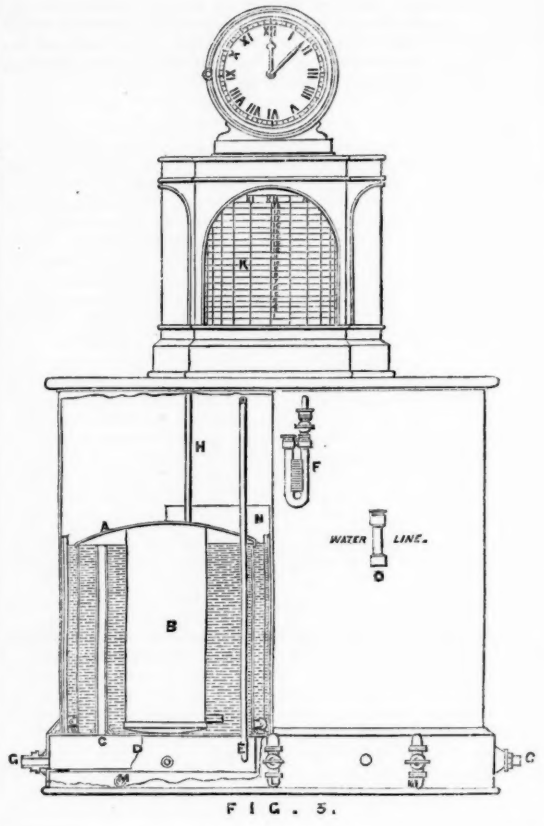


FIG. 3.

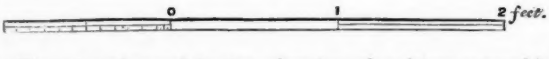


Fig. 2 is a plan, and fig. 3 an elevation of registers arranged by myself for the Bath Gas Company. The peculiarity of the arrangement consists in the use of two holders on one clock and cylinder, whereby two registers are obtained without making the instrument in the least degree more complicated than the old machine. The instrument is shown partly in section. The two holders, of course, are quite independent of each other. One of them, A, is shown in the elevation; the two are dotted in on the plan A A. B is the float. C, the stand-pipe. D is a passage communicating with C, and E a pipe for an ordinary pressure-gauge, F. Each union-joint, G G, connects these pipes and passage with a separate main for each holder, A A. H H are the rods guided by the friction-wheels, I I I I I I, carrying the pencils, J J, for registering the rise and fall of the holder and variation of the pressure on the recording cylinder, K. This cylinder makes one revolution in forty-eight hours; hence, if two twenty-four-hours register-papers are attached to it, and the pencils are worked at opposite points on the cylinder, a record of the working of each holder will be kept for twenty-four hours. The cock, L, is for the supply of fresh water; the dirty water is withdrawn from the instrument through M M. The partition, N, divides the tank into two parts, and strengthens it, forming a tank for each holder to work in. To each tank a water-gauge is attached for indicating the height of the water; and to each holder a pressure-gauge, F, is connected as a check against the registers.

*Bath, September*, 1859. W. J. WARNER.

## Register of New Patents.

609.—JAMES PILBROW, of Tottenham, Middlesex, civil engineer, for "*Certain improvements in, or a new method or methods of obtaining and applying motive power, a modification of which is also applicable for pumping or forcing liquids, gases, and fluids.*" Provisional protection only obtained. Dated March 9, 1859.

A flexible and elastic tube, such as the red mineralized indiarubber, is placed between two rollers, or between one roller and a flat surface, and being pressed together with a force (by the agency of springs or otherwise) sufficient to close the tube at the point where such rollers are placed—the diameter of the bore and thickness of material of such tube being made in proportion to the effect it is intended to produce, one end of the tube being left open to the atmosphere, and the other end being in connexion with an air pump—upon the air being exhausted from the tube it will collapse by the pressure of the superincumbent atmosphere. Thus let the rollers be placed out of equilibrium as respects the pressure or elastic force of the tube on either side of them, and hence let them move towards, over, or along the collapsible part of the tube with attractive or repelling force in proportion to the power necessary to collapse the tube, or, in other words, as is due to the elastic force or power of the tube to spring open or resume its original shape—if then the tube be made in proportion to its size, of such a thickness that it would require 14 lbs. to every square inch of its surface to collapse it, the air being exhausted from it, the atmosphere would cause it to collapse, and, upon being readmitted, or the interior and exterior of the tube being again placed in equilibrium, the tube would expand to or regain its original circular form with a force equal to what it required to compress it, and therefore the rollers would receive an effect on one side of them to urge them forward to this amount.

If such a tube be placed within and around a circular and air-tight chamber, and a wheel, having rollers similar to those before described attached to its periphery, placed in position, the one end of the tube being free and open within the chamber, and the other end passing out of it, either open to the atmosphere or connected with a condenser, and steam at sufficient pressure be supplied to the chamber, the steam thus becoming the substitute for the air, the rollers would be propelled along the tube around the chamber, carrying with them the wheel; which wheel, having an axis passing through the chamber by steam-tight stuffing-boxes, it would give a rotary motion to any machinery, and thus form a steam or other engine, according to the medium used.

This particular form or modification may be varied in several ways, or made to act with water, or gas, or air under pressure, the principle remaining the same, and therefore within this invention. The same arrangement will also answer as a meter to measure water or gas, as also, by being forced round by external power (in place of its yielding power), will form a pump.

637.—JOHN COURT, of Brompton Row, London, gas-fitter, for "*An improvement in nibs for gas-burners.*" Patent dated March 12, 1859.

This invention consists in forming a chamber in the nib, and filling the same with a number of layers of fine wire, perforated plates, or other porous material, through which the gas passes. The progress of the gas is thereby retarded, and its pressure diminished; it also becomes heated in its course through the nib, and more complete combustion, and, consequently, increased illuminating power, is the result. The chamber is formed either by boring the nib at the bottom of sufficient capacity to receive the layers of wire or other material, and inserting a plug (previously drilled through for the passage of the gas) in the bottom of the nib, which presses on the material so placed, and confines it in its position; or the nib at the top is bored, and, after placing the wire gauze or other material, it is confined in its position by an iron, earthen, or glass tip being fixed in the top of the nib. This tip is drilled or slit as in the ordinary union jet or batswing nibs.

The claim is for the formation of a chamber in the nib of gas-burners, and filling or placing therein wire gauze, or other porous material, through which the gas passes in manner and for the purpose described.

642.—ALFRED TYLOR, of Warwick Lane, Newgate Street, for "*Improvements in apparatus for regulating the supply of water to water-closets and other vessels.*" Patent dated March 14, 1859.

This invention has for its object improvements in apparatus for regulating the supply of water to water-closets and other vessels. For this purpose the supply-pipe is connected to one end of the top of a chamber, in the bottom of which chamber there is a cylinder in which a piston works. To the other end of the top of the chamber a pipe is connected, and it passes to the pan of the closet or other vessel. The end of the supply-pipe is closed by a valve, which is attached to the end of one arm of a lever. The other arm of this lever is by preference of a curved form, and passes through a slot in the piston-rod of the piston, which works in the cylinder below. Through the piston there are a number of holes, and to the centre of the bottom of the piston a disc of indiarubber is attached, which, when the piston is moved downwards, prevents the passage of the water through the holes, but, when the piston is moved upwards, permits the water to flow through freely. From the bottom of the cylinder a small pipe passes into the chamber above, and on this pipe there is a cock to regulate the speed at which the water may flow through the pipe. The piston-rod of the piston passes through a stuffing-box in the top of the chamber, and is attached to the weighted lever to which the handle is ordinarily attached. By these means, when the handle is lifted, the piston will be moved towards the top of the cylinder, and the valve will be moved away from the end of the supply-pipe; the water will then flow

through the chamber into the pan or other vessel until the piston is again forced down, when the valve will be again forced against the end of the supply-pipe, and the supply of water stopped.

No claim is made to the mechanical parts separately, but the claim is for the combination of apparatus above described for regulating the supply of water to water-closets and other vessels.

644.—DAVID JOY, of Leeds, engineer, for "*Improvements in hydraulic engines and meters.*" Patent dated March 14, 1859.

The first part of this invention applies equally to motive-power engines and meters, and consists in making the working cylinder of the machine reciprocate within a chest while the valve for induction and eduction remains stationary. The cylinder is moved at each end of the stroke either by mechanical means like a valve, or in revolving engines by the piston itself coming in contact with the end of the cylinder, or it works in the two ends of the chest like a piston, and is moved by the water being admitted alternately into either end of the chest, or it is hung in the chest between two diaphragms, and the water admitted as before between the diaphragm and the ends of the chest.

The second part of this invention relates to the ordinary form of hydraulic hoist and water-engine, and consists, firstly, in the use of two or more cylinders and rams working within each other telescopically, which forms a hoist of various powers, the water being admitted to any one of the cylinders, according to the weight to be lifted. Secondly, in this and the ordinary form of engine, when a sliding valve is used, there is placed on the back of that valve one or more small clack-valves over that part which closes the port at lap, as relief valves to the port thus covered.

The first part of this invention relates to hydraulic engines of the cylinder and piston construction (reciprocating), and also to water-meters of a similar construction. The improvements consist in making the cylinder moveable to a limited extent in the same line as the piston, within a chest or chamber common to both cylinder and valve or slide, and in which what usually answers the purpose of a valve or slide, or valves and slides, for admitting and providing exit for the water or other fluid to and from the piston is stationary.

The cylinder may be actuated by an eccentric or cam on the rotating-shaft (in water-engines), or by the piston coming alternately in contact with the end of the moveable cylinder before the termination of the stroke, thereby opening the whole or a portion of the port as "lead," the remaining opening being effected by the water thus admitted during the period that the piston is commencing its return stroke; or by admitting the water through a separate moveable slide or cock, being wrought by the motion of the piston at the termination of its stroke.

When arranged for a water-meter, instead of sliding the cylinder in the two ends of the chest, it is suspended between them on two diaphragms of elastic material, the spaces between serving instead of the cylindrical recesses in the other engine; the bottom of the chest is made to serve for the valve, the ports in the cylinder serving for both inlet and outlet. The supplemental valve is, in this case, placed between the face of the cylinder and that of the ports or outlet, and is moved by the piston coming in contact with tappets sliding through a slit in the cylinder, but kept close by the face of the valve. This supplemental valve, as before, admits and educts the water alternately between the ends of the cylinder and the ends of the chest, and so causes the cylinder suspended by the diaphragms to move over the ports in its back, opening alternately the two ends of the cylinder to the inlet water in the chest, and at the same time allowing the exit water to escape at the opposite port through the valve. The piston slides loosely upon a bolt which holds the cylinder ends and diaphragms together. The measure is obtained by counting the strokes or movements of the cylinder, which is done by attaching a counter to a pin, which is pushed out by every movement of the cylinder towards one end of the chest and is returned with a spring.

The second part of this invention relates to hydraulic hoists, and is also applicable to presses in which the pressure of the water is applied to raise or lower weights, or compress merchandise or other material, and consists of two varieties of combination: first, those in which two or more moveable rams are arranged concentrically within one external cylinder, or, as may be transposed, "in reverse," having two or more concentric cylinders moving upon one central ram in such a manner that the pressure of the water or other fluid can be admitted either upon the effective area of the central ram or cylinder only, or upon the others successively and additionally, and thus to accommodate the amount of effective area upon which the pressure of the water is allowed to operate to the amount of resistance to be overcome. These hoists, or lifts, or presses may be fixed vertically or horizontally, or in any other convenient position. In all cases the moving parts are free to act, and are restrained only by the non-admission of the hydraulic medium—the effective area of such rams or cylinders being open to receive water freely back again from the exhaust when not otherwise open to the pressure from which the moving power is derived.

The other arrangement consists in so arranging the effective areas of the rams and cylinders that the pressure of water can be admitted exclusively upon any one of them, or upon any greater number collectively. The relative proportion of these effective areas may be constructed as is most convenient, but it is preferred to make them, when there are two, in the ratio of 1 to 2, and when there are three, in the ratio of 1, 2, and 3, and so on. Thus, in the former instance, a choice of three powers can be obtained—namely, 1 and 2, and $1 + 2 = 3$; and in the latter case, six powers can be obtained—viz., 1, 2, and 3, and $3 + 1 = 4$, and $3 + 2 = 5$, and $3 + 1 + 2 = 6$.

The admission of water upon the separate areas can be effected by suitable valves, slides, or cocks, as is most convenient.

A further distinctive feature in this invention consists in disposing the rubbing surfaces of such rams, cylinders, or pistons at such distances from each other in the line of their motion (generally about the length of the stroke apart) as to give the necessary guidance to keep the moving parts in one common centre line, without the necessity of any further slides or guides to preserve the cylinders, rams, or pistons in their correct positions for a free action under the influence of the water upon each or any of them. But in the arrangement above described the power is reserved, in certain cases, to keep the surfaces in contact nearer together in the line of their motion, and to apply a guide in any convenient manner.

In cases where it is necessary to increase the stroke developed by such apparatus, or where the distance to be raised or lowered exceeds the stroke of the rams or cylinders, it is convenient to apply blocks or pulleys with ropes or chains, the patentee applies, in some instances, a continuous rope or chain of twice the length, and half the strength, and with twice the usual number of fixed and moveable pulleys, so as to neutralize any oblique strain upon the moving parts, and prevent any tendency in them to deviate from the proper centre of motion.

The claims are for—

1. The arrangement of hydraulic engines and water-meters, where the cylinder is made to reciprocate instead of the valve, for alternating the flow of water to and from the two ends of the cylinder, whether the cylinder be moved by an eccentric or cam, or direct from the piston or piston-rod, or by the admission of water upon its alternate ends.

2. The use of two or more cylinders and rams working within each other, on which the water is admitted consecutively and additionally, for producing varied powers, which is further effected by disposing such cylinders and rams as to receive the water upon any one of them exclusively or upon any number of them.

3. The addition of a relief-valve or clack upon the slide-valve opening back upon the water-pressure and delivering either into the chest or into the exhaust.

648.—JOHN SAMUEL DAWES, of Smethwick House, near Birmingham, gentleman, for "*A new or improved method or combination of arrangements for the better securing and collecting of night soil or town manure, and rendering it more valuable for agricultural purposes.*" Patent dated March 14, 1859.

This new or improved method of securing and collecting night soil or town manure consists essentially in so constructing the privy buildings or closets that the whole of the solid and liquid excreta produced may with facility be collected and removed, free from that admixture of water and rubbish which have hitherto washed away, or otherwise in great part, destroyed the agricultural value of these matters. In addition to this, by deodorizing the same the unsightly and destructive nuisance of the present method of removing night soil is done away with.

The privy building constructed according to this invention consists by preference of two compartments under one roof, and at a greater elevation than is usual with such buildings, so as to allow of a manure-chest or small waggon being placed in the compartment on the ground floor, as it will usually be found convenient so to place it. The manure is received in the chest or waggon through a steeply inclined channel, and over this manure-chest or receptacle an iron or strong wire screen is placed in a slanting direction, so that when the ashes from the house fires are thrown upon it, all the fine alkaline particles contained therein will pass through, together with so much of the fine cinder or coke as may be found sufficient to absorb the offensive gases evolved from the manure, thus adding greatly to the value of the said manure. The larger gleeds of the ashes pass off at the lower end of the screen, to be reburned. The manure-chest is about three feet in length, about two feet high, and the same in width, and is supported on wheels. A farmer's waggon, with two horses, will readily remove six of the manure-chests. The screen is about two feet in breadth at the top, tapering to a foot at the lower end, and the apertures in it are about three-eighths of an inch, but will require to be larger or smaller to suit the requirements of the locality where it is used. The screen may be either moveable or fixed, and placed either lengthwise or crosswise over the chest, each plan being found to answer in practice. The channel down which the manure passes is from ten to twelve inches broad, open towards the chest, and formed of smooth slate or other suitable material. The end of the lower portion of the compartment is closed by a door opposite the chest or waggon, and a similar door is placed immediately over it, through which the urinals are daily emptied into the manure-chest. On removing the manure-chest it should be covered with a close-fitting lid, temporarily placed thereon.

It may here be observed that in applying these improvements to privy-closets in upper rooms, although the sifted ashes may still be used, care must be taken that the manure-chest, cover, and lid over the channel be fitted air tight; and it may be convenient on all these occasions, by means of a tap, to use a certain quantity of solution of chloride of lime, or other well-known disinfectant, which will add its full cost to the value of the manure.

It is obvious that these improvements can only be extensively and properly carried out under legal enactments and the strict supervision of the police, but, if generally adopted, will not only add immensely to the wealth of the country, but effectually check one of the most active agents in generating disease.

The claim is for the new or improved method or combination of arrangements for the better securing and collecting of night soil or town manure, and rendering it more valuable for agricultural purposes—*i.e.*, so constructing the privy buildings or closets that the excreta may be collected in moveable receptacles without nuisance or any admixture of water or rubbish, and sufficiently deodorizing the same by mixing with it the fine ashes and cinders produced in the house fires, or by other disinfecting agents.

## PROVISIONAL PROTECTION

HAS BEEN GRANTED FOR THE UNDERMENTIONED INVENTIONS.

1814.—CHARLES CLAUDE RAYMOND GOUDENOVE and ADOLPHE FERRET, both of 60, Rue Neuve St. Augustin, Paris, merchants, for "*An improvement in gas-burners.*" A communication. Aug. 6, 1859.

2002.—JOHN KIPPEN WATSON, of Edinburgh, gentleman, for "*Improvements in gas-meters and exhausters, washers and purifiers.*" Sept. 2, 1859.

2055.—THOMAS WEBSTER ALLSOPP, of Castle Donnington, in the co. of Leicester, for "*Improvements in portable gas apparatus.*" Sept. 8, 1859.

## NOTICES HAVE BEEN GIVEN OF INTENTION TO PROCEED WITH THE UNDERMENTIONED INVENTIONS.

1140.—SAMUEL WRIGHT, of Sudbury, in the co. of Suffolk, gas engineer, for "*An improved gas governor or regulator.*" May 6, 1859.

1170.—Moses Defries, of Houndsditch, London, manufacturer, for "*Improved apparatus for regulating the pressure of gas.*" May 10, 1859.

1242.—Robert Wilson, of Patricroft, near Manchester, engineer, for "*Improvements in hydraulic machinery.*" May 20, 1859.

1567.—Bridge Standen, of Salford, in the co. of Lancaster, for "*Improvements in the deodorizing and separation of fecal and putrescent organic matters in the preparation or manufacture therefrom of a portable artificial manure or fertilizing compound, and in apparatus to be employed in such preparation or manufacture.*" July 1, 1859.

1731.—William Edward Newton, of 66, Chancery Lane, London, civil engineer, for "*Improvements in extracting oil from coal and other substances yielding pyrogenous oils.*" A communication. July 25, 1859.

1742.—John Davies, of Tetbury, in the co. of Gloucester, machinist, for "*A new or improved self-adjusting ventilating apparatus.*" July 27, 1859.

# Miscellaneous News.

## CITY OF LONDON COURT OF SEWERS.

GUILDHALL, TUESDAY, SEPT 13.

The Weekly Meeting of the Commissioners was held this day—Mr. Deputy Christie in the chair

APPOINTMENT OF SOLICITOR.

Mr. Barkley said he had given notice that he should at this meeting propose the following motion:—"That the resolution of the commissioners of the 19th of July, 1859, whereby Charles Pearson, Esq., City solicitor, is appointed the solicitor of the commissioners temporarily, be rescinded." When that notice was placed upon the paper, the bill of the City of London Gas Company was before the House of Commons, and was being vigorously opposed by the commissioners. He therefore considered that the solicitor of the corporation, who had a large interest in the Great Central Gas Company, was not a fit and proper person to act as the legal adviser of this court, even *pro tem.* But since then the City Gas Company had obtained their bill, and, under present circumstances, he (Mr. Barkley) would ask permission to withdraw his notice of motion.

Mr. Elliott: May I ask the question whether any account has been received by the commissioners of the amount of public money which has been expended in opposing the bill of the City Gas Company?

Mr. Daw (chief clerk): The bills are not in yet—probably they will not be for some time.

Mr. Elliott: Perhaps you can tell us whether they will amount to thousands?

Mr. Daw: No, I cannot tell you. I only know that I have had a great deal of trouble, and nothing for it.

The Chairman: All I can say is, that the gas company have got all that they asked for.

Mr. Young: Has there been any money paid to the solicitor on account?

Mr. Daw: No; the solicitor has had nothing. There has been £300 paid to the Remembrancer.

The application to withdraw the motion was agreed to.

GREAT CENTRAL GAS—QUARTERLY REPORT.

Dr. Letheby reported that he had made 246 experiments on the illuminating power of the gas supplied by this company to the City, and the results were, that the mean illuminating power was equal to that of 11·51 sperm candles, or 13·15 wax of standard value. This is about 10 per cent. above the requirements of the Act of Parliament. The gas has also been of very uniform quality, and has been perfectly free from sulphuretted hydrogen. It has contained only traces of ammonia and tarry matter.

PURIFICATION OF THE THAMES.

Mr. Young said complaints had been made by the inhabitants of Warwick Lane of the nuisance occasioned by the operations of the Metropolitan Board of Works in deodorizing the sewers.

The Inspector said the nuisance arose from the application of oil of tar and lime in the sewers.

Deputy Obbard said several of the inhabitants of Farringdon Without had been to him complaining of the nuisance. They thought at first that the gas people, having got their bill, were careless whether or not their works were a nuisance to the neighbourhood; instead of that, it was the Metropolitan Board of Works endeavouring to cure the Thames.

## THE CHEAP GAS MOVEMENT IN GLASGOW.

A public meeting was held on the 14th inst. in the City Hall, in connexion with the cheap gas movement. The meeting was called by the Lord Provost, in compliance with a requisition signed by 1446 gas consumers, to consider the Act for regulating measures used in sales of gas (Lord Redesdale's Act), and also to adopt such steps as should be deemed necessary to effect an immediate reduction of the price of gas in this city from 5s. to 3s. 6d. per 1000 cubic feet. The area of the hall was nearly filled, and also the side galleries. On the platform we observed—Robert Dalglish, Esq., M.P.; Adam Pringle, Esq.; Alexander M'Kenzie, Esq.; Bailie M'Adam, Councillor Raeburn; John Robert Baird, Esq.; Matthew Bulloch, Esq.; William Melvin, Esq.; George Smith, Esq.; — Murdoch, Esq.; Charles J. Small, Esq.; Edward S. Busby, Esq.; Charles E. Irwin, Esq.; John C. Foulds, Esq.; William Okell, Esq.; Messrs. Couper, Selkirk, M'Gregor, &c. &c.

On the motion of Bailie M'Adam, Mr. Moir was called to the chair, and took his seat amidst applause.

The Chairman read the requisition calling the meeting, and directed attention to the fact that the requisition was signed by 1446 gas consumers, composed of the principal merchants and manufacturers of the city.

Mr. Moir then read a letter of apology from Mr. M'Dowall, who was to have presided, had he not been called from home. Mr. Moir then said: In Mr. M'Dowall's absence I have agreed to occupy the chair, and in doing so I beg leave to say that I do not appear as a partisan either on the side of the gas companies or against them. I think the inquiry which the gentlemen who have been the means of bringing us together have set on foot, is a perfectly legitimate and proper inquiry; that is to say, I think it is quite a proper thing to ascertain whether we are paying a fair price for our gas or otherwise. If it is a fair price it is important that everybody should be satisfied, and if we are paying rather more than we ought to pay, it is equally necessary that we should be informed of that, and operate accordingly on the gas companies. I will say nothing additional to what I have said, but will call upon gentlemen who have given this matter a good deal of consideration of late, and who are prepared to state the reasons they have for thinking that the price ought to be reduced (Applause.)

Mr. Adam Pringle, of Messrs. Okell, Pringle, and Selkirk, who was heartily received, said: I am persuaded I speak the sentiments of every individual whose name was attached to the requisition, when I say how much we appreciate the readiness evinced on the part of the Lord Provost in acceding to our wishes. Doubtless the importance of the subject, in every point of view, but especially as it affected the interests and well-being of so populous a city as Glasgow, was deeply felt, and this large and influential meeting is the result. Since the gas consumers' committee availed themselves of the valuable services of Mr. Flintoff, gas engineer, from London, they have held several meetings in different districts of the city, with two objects in view—first, to disseminate a knowledge of the subject in all its details, and thus awaken in the mind of the public a consciousness of the injustice inflicted by the gas companies; and, secondly, to render popular this movement, which has for its object a large reduction in the price of gas. I trust the issue of this meeting will bring about this result, not only for the city of Glasgow, but for every other town in Scotland where a gas company exists. (Cheers.) In the City of Glasgow, as you are aware, there exist two gas companies, the one established in 1817 and the other in 1843. The first of these made three applications to Parliament within eight years for an increase of capital, and had raised, up to the year 1825, by the appropriation of shares amongst themselves at par, the sum of £100,000. In 1826 a fourth application was made, and the company obtained leave to raise £50,000 additional, but not on the same terms as before, and to this point I beg your special attention. At an early period in the history of gas and water companies, individuals who embarked their capital in such undertakings were considered little short of benefactors to their species, and as it was most desirable that these necessaries of life should be supplied to every town in the kingdom, every facility was afforded on the part of the public, and the most unlimited powers granted to all and sundry promoters of bills in Parliament having such objects in view. Then it was, however, that directors charged what prices they pleased, divided dividends which best suited their purpose (for it did not always suit their purpose to acknowledge their prosperity by dividing large dividends), creating new shares to absorb the increasing profits, and by proceeding in this manner put into their pockets large bonuses, which often exceeded in amount the original capital invested. Meanwhile the exorbitant price charged for gas by the different companies then established varied from 45s. to 15s. per 1000 cubic feet, the Queen Square Gas Company, of Liverpool, to my knowledge, charging the former sum. These high prices became not only a tax on the trading community, but acted as a prohibition on the poorer classes from enjoying the advantages of gaslight. Representations were consequently made to Parliament, setting forth the evils which existed, and suggesting remedies, when a clause was introduced into all future bills whereby these philanthropists were prevented from dividing more than a 10 per cent. dividend, and all surplus profits were to go towards a reduction in the rate charged for gas the following year. By the introduction of this clause, in 1825 consumers were admitted partners in the undertaking, their share of the profits being payable in the form of an annual reduction in the price of gas. The utmost satisfaction, therefore, prevailed, and another clause having been inserted whereby certain parties representing gas consumers had access to the books of the company with a view to their investigation, it was thought that all further cause for contention had ceased; but, sir, so far from this being the case, the whole history of gas and water companies since 1825 has been characterized throughout by the most disgraceful efforts to evade the spirit of their Acts of Parliament; and as the sequel shows, these highly beneficial clauses, which appeared to strike at the root of all the abuses that existed, became in a short time of little more value than the paper they were written on, inasmuch as, while the first-mentioned clause limited the dividend to be paid, the directors soon discovered that it did not limit the amount of capital to be employed; neither did it limit, nor in any manner check, the reckless squandering of that capital when it was raised, first by carrying their mains and pipes through miles of desert regions, totally unproductive of profit to the companies, and next by perpetuating the use of antiquated machinery and modes of making gas which rendered the cost price so much the greater. In 1826, therefore, when the company paid its fourth visit to Parliament, seeking to raise the £50,000 referred to, it was granted on the following terms—viz., that the shares should be sold by public auction, and the premiums obtained on the same should not go into the pockets of the shareholders as before, but become capital to be spent in the general extension of the works, and on which no dividend whatever was to be paid. Those sums I have mentioned, with £10,000 borrowed money, constituted the capital, and the "Old Gaslight Company" enjoyed undisturbed possession of the field for twenty-six years. In 1843, the public of Glasgow, tired of making representations of the bad quality of the gas supplied, the high price charged, viz., 10s., and of the great scarcity which prevailed (for I am told that if the city had been in comparative darkness, as it frequently was in the foggy days of November, not a jet was permitted to be lighted)—the gas consumers, I say, tired of making fruitless appeals to the directors for redress, resolved to form a new company; and having obtained an Act of Parliament, with power to raise £150,000, the "City and Suburban Company" came into existence. It had been stated by the old company that to sell gas for less than 10s. per 1000 cubic feet, would be ruinous to the shareholders. Yet, nevertheless, to prevent, if possible, the establishment of a new company, they dropped the price to 8s., and when competition was admitted, to 6s. 8d. Still, not only were they not ruined, but, to the surprise of all, their dividends were as good as before; and not only so, but while the City and Suburban directors remained in a state of innocence, and managed the trust reposed in them with fidelity and care, further reductions took place until the price fell so low as 4s. 7d.; and the same good result followed—nay, larger dividends were declared. (Cheers.) At this price, however, a dead pause ensued—a fall of another kind took place: a friendly understanding sprung up between the companies; healthy competition, with all its attendant advantages, ceased to exist; and in 1857—though the price of gas had fallen during the previous ten years, in every town in the kingdom, from 20 to 40 per cent.—yet to the great surprise of gas consumers, who received the announcement with regret and indignation, both companies, by private arrangement with each other, simultaneously raised their price to 5s. (Hear, hear.) Now, gentlemen, we allege, in the first place, that the gas companies have broken faith both with Parliament and ourselves; that by the dividend clause inserted in 1825, they were bound to reduce the price of gas when by their annual balance-sheet any surplus profit was shown to have been made; but instead of doing this, the surplus profits have been systematically understated, and sums of money have been abstracted from time to time from profits, and accumulated in secret funds known by a variety of names—"reserve-funds," "suspense-accounts," "depreciation-funds," "loan from income to capital account;" and many of these amounts, of which the public have been deprived of the benefit, have been by some gas companies capitalized, new shares distributed amongst the shareholders to represent the capital thus created, and the public have been made to pay on these shares a dividend of 10 per cent. The old gas company, between the years 1825 and 1842, misappropriated the funds belonging to the public in this

manner to a large extent. I have in my hand a report made to the Town Council in 1843 by Mr. Ord, accountant, who stated that the company confessed to him to have spent a part of their surplus profits otherwise than in reducing the price of gas. The extract I am about to read I copied from the *Glasgow Courier* of March 18, 1843:—"In terms of a remit made to him and a mandate given to investigate the books of the Gaslight Company in reference to the application of its profits, Mr. Ord gave a report, from which we extract the following details:—'The revenue, disbursements, &c., from the 31st of May, 1825, to the 31st of May, 1842. The receipts amount to £606,274, and the expenditure to £405,864; dividends paid, £200,410. The sums set aside to meet depreciation of works and contingencies, and those placed to triennial suspense-accounts, amount to £57,349.' The reporter stated that the surplus funds have not been all applied in reducing the price of gas to consumers, and, as stated to him by the secretary of the company, they admit this. They admit that part of the surplus funds have been applied to the extension of the works. The reporter stated that the shareholders had not been drawing any higher dividend than that pointed out by the Act, viz., 10 per cent., and added, that his reception at the office was polite and courteous, and every facility was afforded him in inspecting the books." Now, sir, I maintain that these abstractions of the funds of the company, from time to time, are not only illegal, but essentially unjust. Parliament granted no authority to form these secret funds, with the exception of a contingent-fund of £5000, which was afterwards increased in amount; nor was it the intention of the Legislature that consumers, besides paying for their gas, should also contribute to keep up the original value of the works and plant of any gas company. On the contrary, I maintain that it is clearly the intention of Parliament that the shareholders should repair, and rebuild, and reconstruct their own works and machinery, when in a state of decay, in the same manner as any other owners of property—viz., out of their own pockets; and this they can afford to do out of a 10 per cent. dividend and a monopoly of supply which they enjoy. And in carrying out the principle laid down, I venture to assert, further, that the premiums arising out of the sales of shares, which have hitherto, by an error in legislation, been permitted to form part of the capital, and have been applied to the extension of the works and operations of the companies, should have been carried to the credit of profit and loss account, and thereby rendered applicable to the general charges and payment of dividend, and by this means the consumers would have reaped the advantage. Gentlemen, if in 1843 an accountant was appointed and an investigation of the books of the company took place, how is it with the disclosures then made, that no report has since been made? (Cheers.) In Liverpool it is done annually; and there lies before me at this moment the reports for the last few years of that town, in which the financial affairs of the company are rendered so plain that they can be comprehended by the meanest understanding. Are the members of the Town Council of Glasgow still the parties we look to as the protectors of the public interests, or has the vigilance which characterized them in 1843 entirely forsaken them now? (Cheers.) By the appearance of the gas companies in Parliament in 1857 a fitting opportunity was afforded for exposing these various acts of injustice and of obtaining the aid of the Legislature to compel a restitution of the moneys so misappropriated; but what was the result of their proceedings? They appointed a deputation at the eleventh hour, who, proceeding to London, instead of addressing themselves to the subject with a *bonâ fide* intention of opposing the company's bills, spent their time and the money which belonged to the public in furthering the accomplishment of a hobby of their own—viz., that the corporation should buy up the old worn-out and decayed works and plants of the companies, at the enormous cost of £680,000, and which you will be told by Mr. Flintoff, supported by the testimony of the first gas engineer in the world—Mr. Samuel Clegg—could be placed there for something like £200,000. (Cheers.) The good sense of the Town Council prevailed, and prevented this egregious act of folly from being committed; but, while these negotiations were going on in London, the companies' bills, with all their obnoxious clauses, passed through the committee, and, amidst this mockery of acting for the interests of the public, I have no hesitation in saying the public were most cruelly sacrificed. But, sir, I shall be told that I am mistaken—that a most important alteration was effected by the deputation—viz., a reduction in the rate of dividend to be paid on the new capital from 10 to 7½ per cent. Now a most mistaken and fallacious idea is attached to this, as I shall presently show. Indeed, it is a mere delusion. Had they raised the dividend to 20 per cent. instead of reducing it, it would have made no difference. Let me explain. A 10 per cent. dividend, when the shares are sold in the market by public auction, produces a premium of £100 per cent.: or, in other words, a £50 share sells for £100, but with a 7½ per cent. dividend it sells for only £75. So that a company desirous of raising £100,000 with a 10 per cent. dividend would have to sell only £50,000 worth of stock, but they would have to dispose of £65,000 worth to produce the same amount with a 7½ per cent. dividend. It is plain to demonstration, therefore, that a reduction of the dividend has only the effect of increasing the total share capital, and the burden to the community remains the same. (Cheers.) Gentlemen, though the subject is dry and its details embrace little of the excitement of politics or the interest of moral or social disquisition, yet it is really of the vastest significance. If we condemn the industrious weaver to his nightly loom, in the name of humanity let us light him cheaply to his work. If the poor sempstress has to stitch for twelve or fifteen hours a day to make a livelihood, it is high time we took measures to enable her to see to have something to stitch by. Light and water have been, and still are, in most communities little better than scandalous monopolies. Elements that should be as general, as accessible, as cheap as air, are dear and scarce, and difficult to come by. It is no justification of half measures to say that these necessaries are so much cheaper than they have been. With light and water there should be no halting short of being as good and as cheap as they can be. If we can have water for less than its present charge, the poor have a right to have it. If we can enjoy the cheerful light of gas for 30 per cent. less than its present price, labour has a right to demand it at the hands of the community. Every weaver and artisan, every shopkeeper and victualler, has a permanent interest in this question; and since huge combinations of gas monopolists in conspiracy together exist all over the country, it is imperative on the part of the public to combine in self-protection, as we are now doing, for the purpose of reducing this commodity to the lowest possible rate. (Loud cheers.) I beg to move the following resolution—viz., "That in the opinion of this meeting, the price charged for gas by the companies established in this city is unnecessarily high, and ought to be immediately reduced; that inquiries ought to be made into the management of the affairs of the gas companies, to ascertain whether, in terms of the Acts of Parliament under which they are constituted, they have applied their surplus profits in reducing the price of gas to consumers; and such other measures ought to be taken as may be considered advisable and expedient, with the view to obtain such reduction."

Bailie M'Adam, in seconding the motion, said: Mr. Pringle has spoken so well upon this matter, that I trust it will not be expected from me that I shall make a speech at all. But I will tell you that we ought to make some effort in this matter. The gas question is in your own hands—in the hands of the public of Glasgow. There is no doubt whatever that great improvements have taken place in Glasgow within the last twenty or thirty years, and perhaps you will permit me to allude to one or two of them, which have been originated at meetings like this, taken up by the press, and ultimately, in some instances, by the Town Council of Glasgow. With regard to the state of the streets, for instance, twenty or thirty years ago, I remember quite well that, not above 200 or 300 yards from this place, in the Trongate, there were holes in the street where you could have buried a cart for a twelvemonth, while carters had to come off their carts and drivers off their carraiges to lead their horses. Matters are very different now, for there are no streets in any capital of Europe to be compared with our own in respect of paving. Then there was a desire for many years, on the part of the public, ably seconded by the press, to get public parks for Glasgow, lungs for the city. The Green was thought to be too far away for the working classes in Anderston and the north, and then there was originated one of the most beautiful parks in the three kingdoms—the West End Park. And I may tell you at this point that this park is now to be very much improved. A very active committee is taking steps to prevent the sewerage of the upper part of the city from flowing into the Kelvin, and so we hope very soon to have the Kelvin in all its pristine purity. Another improvement which gives us encouragement is the introduction of a good and plentiful supply of water. I am glad to tell you that, by the middle of next month, we expect to have that abundant and pure supply of Loch Katrine water into Glasgow. (Cheers.) I mention these things because I am not prepared to speak on this gas question; but I allude to them as encouragements for us. I trust, therefore, that every one here—for I suppose every one here is a gas consumer, directly or indirectly—should take an interest in this matter, and if you do so, I am sure we shall soon have gas in Glasgow, from some quarter or other, at 3s. 6d. or 4s. per 1000 cubic feet. (Applause.)

The Chairman then called upon Mr. Flintoff to address the meeting, before putting the resolution.

Mr. Flintoff, who was received with applause, said: The principles which regulate the manufacture and distribution of gas are imperfectly understood, and the want of information on this subject has had a tendency to deprive the public of the benefits which are inseparable from a good supply of cheap light. Most gas companies have erected their works when machinery was expensive, the processes of gas-making complicated and bad, and the means of purifying gas miserably deficient. Their plant and apparatus have gradually grown, while the works present engineering incongruities which are incompatible with the present improved state of the science. These defects increase the cost of manufacturing gas, while the waste of capital has a similar effect; for new works, with better machinery, which is less expensive in its application, can now be obtained for about one-third of the sum paid for inferior apparatus by old-established companies, so that a dividend of 10 per cent. is equal to 30 per cent. on a modern outlay. Nor is this the worst feature. The loss from leakage in the street mains ranges from 20 to 40 per cent., and from every 1000 feet of gas passing from the gasholder, full 250 feet is lost in its passage to the consumer. This loss, which is to a great extent ascribable to the mismanagement of the gas companies, has to be paid for by the public in the form of an increased price for gas; and it has been stated by a leading member of the Town Council that this loss from leakage in Glasgow amounts to from 1s. to 1s. 6d. on each 1000 feet sold. This leakage is increased by conveying gas into unprofitable districts, for the loss from this cause on a mile of pipes, supplying forty or fifty consumers, is generally as great as the loss from a pipe of the same length in the centre of the city, which frequently supplies from 400 to 500 consumers, and the profits obtained in the densely-populated districts are positively wasted to prevent a reduction in the price of gas. It may be asked—Why do gas companies take their pipes into such districts? It is because their profits in Glasgow proper exceed the prescribed limit to their dividends of 10 per cent. per annum, and rather than reduce the price, they seek a field for the further investment of new capital, and by taxing the gas consumers of the city to enrich themselves. Their shares sell in the market for nearly double their original cost. They make gas of whatever quality they please, and through the existence of a solemn compact made between the two gas companies, the public have to submit to exorbitant exactions on a necessary of life. Increased trade brings increased profits, and a public Act of Parliament enjoins that those profits shall be given to the consumers in the shape of a reduction in the price of gas, when a dividend of 10 per cent. is obtained; but the company's dividends never have of late exceeded, and never can exceed, 10 per cent., so long as the pernicious system of wasting the consumers' profits in unproductive districts is allowed to continue. The authorities of this city have the power to investigate the accounts of the gas companies, but, strange to say, this has not been done since 1843, when it was reported to the Town Council—"That the surplus funds have not all been applied in reducing the price of gas, and the company admit this." It is contended that 10 per cent. dividends upon an unnecessarily large amount of capital expended at a very early period, when the science of gas lighting was imperfectly known, on defective pipes and unsuitable machinery, is a great tax on the public, and that high prices under such circumstances ought not to be maintained. It is shown in parliamentary papers that while the average reduction in the price of gas has, during the last ten years, amounted to 1s. 10½d. per 1000 feet, the price in Glasgow is the same as in 1846. In that year the prices were—

| | |
|---|---|
| London . . . . . | 6s. to 9s. per 1000 cubic feet. |
| Liverpool . . . . . | 4s. 6d. " |
| Glasgow . . . . . | 5s. " |

The price of gas in the City of London is now 4s., while the price in Liverpool for the best gas in the kingdom is only 3s. 9d. per 1000 feet. It can be sold as cheaply in Glasgow as in Liverpool, and a reduction to 3s. 9d. would save the consumers about £37,500 a year. In 1843 a new company was formed in Glasgow; it immediately reduced the price of gas from 8s. to 6s. 8d. per 1000; and in 1846 the price was still further reduced to 5s. It subsequently fell to 4s. 7d., but in 1857 the price was again increased to 5s. per 1000 feet; and this virtual amalgamation has cost the city about £12,500 per annum. If in 1846, when coals were 22s. 6d. per ton, gas could be afforded at 5s. per 1000, in 1859, with the consumption of the city nearly doubled, and coals ranging from 12s. 8d. per ton, surely gas can be afforded even by the old companies at 3s. 6d. per 1000 feet. If a reduction of 1s. 10½d. has been made in other towns, it is fair to demand a similar reduction should be made in Glasgow. In 1843 the old company were alarmed by the threatened competition, and men of science were found to state that gas could not be afforded for less than 8s. per 1000 feet. Contrary to these predictions, which went to foretell the utter ruin of the old company, gas has fallen in price, and these injured shareholders have obtained 10 per cent. dividends ever

since, and rumour even points to an increased bonus besides. What has taken place in Glasgow in this respect has been proved to a demonstration in other places, for low prices invariably benefit both the buyers and sellers of gas; for the supply of a good article, at a fair price, always shields a gas company from the introduction of further competition. The capital of the present companies is put down at a little over £500,000. A new company could supply the city with gas for an outlay of £191,649. 17s., and they would get 10 per cent. upon their capital at 3s. per 1000 cubic feet, as will be shown by the following estimate:—

*Estimate of the Cost of Works and Cost of Gas in Glasgow.*

Price per 1000 cubic feet at which gas should be sold, after paying 10 per cent. on the capital necessary to each new work, &c., 2s. 9d.

Cost of works to distribute 600,000,000 feet of gas in one year, with mains to pass 700,000,000 feet of gas in the same period.

| | £ | s. | d. |
|---|---|---|---|
| Engineering expenses | 500 | 0 | 0 |
| Act of Parliament (when required) | 2,000 | 0 | 0 |
| Legal expenses | 600 | 0 | 0 |
| Gasometers to contain 1,600,000 feet of gas, with tanks | 18,320 | 0 | 0 |
| 200 double clay retorts, with hydraulic main and connexions all complete for action | 6,000 | 0 | 0 |
| Condenser, with connexions | 730 | 0 | 0 |
| Purifiers, with valves and lifting apparatus | 1,540 | 0 | 0 |
| Exhauster and engine, with connexion | 725 | 0 | 0 |
| Station-meter and governor | 745 | 0 | 0 |
| Scrubbers | 420 | 0 | 0 |
| Weighing-machine | 150 | 0 | 0 |
| Experimental meters and apparatus | 65 | 0 | 0 |
| Cistern, and tar and water tanks | 780 | 0 | 0 |
| Retort-house and buildings | 3,200 | 0 | 0 |
| 20,000 meters and service-pipes, at £1. 15s. | 35,000 | 0 | 0 |
| 5,000 ditto ditto, at £2. 10s. | 12,500 | 0 | 0 |
| 2,000 ditto ditto, at £3. 10s. | 7,000 | 0 | 0 |
| 1,000 ditto ditto, at £5 | 5,000 | 0 | 0 |
| 200 ditto, various pipes at £10 | 2,000 | 0 | 0 |
| Sundry small items | 1,000 | 0 | 0 |
| | £98,275 | 0 | 0 |

MAINS.

*Note.*—These pipes are 20 per cent. heavier than usual, and coated on Dr. Angus Smith's patent principle, to prevent oxidation.

| Length of Pipes. | Diameter of Pipes. | Cost per yard, including carting, laying, and trenching. | Total. | | |
|---|---|---|---|---|---|
| 15,000 | 2-inches | £0 2 6 | £1,875 | 0 | 0 |
| 38,500 | 2¼ " | 0 2 9 | 5,293 | 15 | 0 |
| 87,500 | 3 " | 0 3 4 | 14,583 | 6 | 8 |
| 35,000 | 4 " | 0 4 5 | 7,583 | 6 | 8 |
| 20,000 | 5 " | 0 5 7½ | 5,625 | 0 | 0 |
| 4,560 | 6 " | 0 7 6 | 1,710 | 0 | 0 |
| 12,500 | 8 " | 0 10 0 | 6,250 | 0 | 0 |
| 12,500 | 10 " | 0 13 9 | 8,593 | 15 | 0 |
| 3,890 | 14 " | 1 1 0 | 8,084 | 10 | 0 |
| 5,750 | 24 " | 2 6 0 | 13,225 | 0 | 0 |
| 2,000 | 30 " | 3 2 0 | 6,200 | 0 | 0 |
| 237,200 | Cost of 157¼ miles of piping | | £79,623 | 13 | 4 |
| | | | £79,623 | 13 | 4 |
| | Repairing 237,000 yards of roads, at 1s. per yard | | 11,850 | 0 | 0 |
| | Add 5 per cent. for irregular pipes, on a sum of £175,149. 16s. | | 2,501 | 3 | 8 |
| | | | £191,649 | 17 | 0 |

*Cost of Manufacturing 600,000,000 Feet of Gas in Glasgow, in 365 Days.*

| | | | |
|---|---|---|---|
| 60,000 tons of cannel, at 14s. 6d. per ton | | £43,500 | 0 0 |
| Lime, at ½d. per 1000 feet | | 1,250 | 0 0 |
| Labour, wear and tear of retorts, works, and mains, inspectors, &c., at 6d. on each 1000 cubic feet | | 15,000 | 0 0 |
| Salaries— | | | |
| Engineer | £400 0 0 | | |
| Secretary | 300 0 0 | | |
| Cashier | 200 0 0 | | |
| Book-keeper | 150 0 0 | | |
| Clerks | 250 0 0 | | |
| Porter | 52 0 0 | | |
| Office boy | 26 0 0 | | |
| | | 1,828 | 0 0 |
| Directors | | 500 | 0 0 |
| Rent and taxes | | 2,500 | 0 0 |
| Stationery, printing, &c. | | 420 | 0 0 |
| Sundry small items | | 583 | 0 0 |
| 15,000 tons of coke to heat retorts | | 5,000 | 0 0 |
| | | £70,581 | 0 0 |
| Deduct— | | | |
| Products of 60,000 tons of cannel—viz., coke, tar, and ammonia, at 5s. 8d. per ton | £17,500 0 0 | | |
| Spent lime, &c., sold | 250 0 0 | | |
| | | 17,750 | 0 0 |
| Cost of 600,000,000 feet of gas | | £52,831 | 0 0 |

| Results— | | | |
|---|---|---|---|
| Cost of 1000 feet of gas, as shown above | £0 | 1 | 9 |
| Allow for losses, leakage, bad debts, &c. | 0 | 0 | 5 |
| Interest— | | | |
| 10 per cent. on £150,000 share capital, 5 per cent. on £50,000 borrowed capital, | 0 | 0 | 7 |
| Selling price of 1000 feet of gas | £0 | 2 | 9 |

| | | | |
|---|---|---|---|
| *Dr.* | | | |
| 600,000,000 cubic feet of gas sold | £82,500 | 0 | 0 |
| *Cr.* | | | |
| Cost of 600,000,000 feet of gas, as shown above | £52,831 | 0 | 0 |
| Allow for leakage, losses, and bad debts | 12,166 | 13 | 4 |
| 10 per cent. on £150,000 share capital | 15,000 | 0 | 0 |
| 5 per cent. on £50,000 borrowed capital | 2,500 | 0 | 0 |
| Balance in favour | 2 | 6 | 8 |
| | £82,500 | 0 | 0 |

With these facts before them, it may be asked—Why do the companies persist in charging 5s. per 1000 for gas? It is because their pipes have not grown with the growth and requirements of an increasing population. Those pipes are already fully worked. To meet the increased demand created by low prices, additional pressure would be required, and the leakage in all probability would be doubled; larger gasometers would be wanted in order to lessen the cost of carbonization, and portions of their buildings and apparatus would have to be removed, and larger and better pipes substituted in many of the leading thoroughfares of the city. This would entail trouble and expense; but as it would benefit the consumers to a greater extent than the shareholders in the gas companies, who are obtaining their maximum dividend of 10 per cent., they seem disposed to move on in the good, quiet, easy, old-fashioned way, rather than effect public improvements for a public good. They are continually parading their own liberality in supplying meters and service-pipes free of cost, while they speak of 20-candle gas, and take credit for condescension and kindness in supplying small consumers, who have paid them liberally, and doubled the value of their original outlay. Previously to the introduction of competition in Glasgow, the old company could get 10 per cent. dividends, and a bonus besides, and meter-rent was charged. The new company abolished the system, and the old company reluctantly followed their example, and it is rather too bad to boast of a supposed concession which was positively forced upon them against their will. The illuminating power quibble is equally ridiculous, for 1000 feet of cannel gas can be afforded as cheaply as the same quantity of coal gas can be supplied at in any large town; and if they are not disposed to afford a good article at a cheap price, by giving the public the benefit which their local position and the best coal fields in the world can afford, it will be discovered to their cost that their business is no longer a mystery while the consumers have the power of helping themselves through the intervention of a new company. The gas companies would gladly sell their works, and a section of the Town Council would be equally glad to buy them. £800,000 is their presumed value; but will the corporation dare to raise £600,000 of public money, when it is shown that £200,000 would do the work in a more efficient manner? Manchester and Paris are pointed to as models of perfection in gas lighting. Her Majesty's Commissioners of Woods and Forests tell us "that a system prevails in Manchester which appears to us to be peculiarly unfair to the consumers of gas, and likely to be most beneficial to men of fortune; while to the shopkeepers and artizans of Manchester the price of gas must necessarily be unduly enhanced by this system." The mania for corporation gas-works is fast dying away. Facts and figures have fortunately dispelled opinions and arguments, and proved how ridiculous it is to place the supply of gas, which is both a manufacture and a trade, in the hands of a municipal corporation. The public know it to their cost, and gladly would they emancipate themselves from its baneful thraldom, for although on paper it appears that £40,000 a year reaches the corporation coffers, it inflicts upon the masses of the people an incalculable amount of mischief. The corporation are no doubt clever, but their wisdom, assiduity, and attention inflicts a supposed advantage on the city, in the shape of a tax of about £70,000 a year, over and above the fair price for gas in Manchester. It was proved by Professor Cooper in the House of Commons that this gas is 25 per cent. worse in quality than Liverpool gas; and, the consumption being about the same in both places, and the average price in Manchester about 4s. 7d. as compared with Liverpool at 3s. 9d. per 1000, how stands this model gas-work, where the cost of making gas is cheaper than in Liverpool (the advantage of one management), no duplicate mains to increase leakage, no rates to pay, and money obtained at 5 per cent., instead of 10 per cent., as is the case in Liverpool? The profits, we are told, in Manchester are about £40,000 a year; if the Liverpool works were transferred to Manchester we should find the matter stand thus:—

| | | | | | |
|---|---|---|---|---|---|
| Profit on 728,000,000 feet of gas, at 3s. 9d. | | | | £52,391 | 8 3 |
| Difference in price from 3s. 9d. to 4s. 6d. | | | | 27,000 | 0 0 |
| Saving of rates and taxes | | | | 2,000 | 0 0 |
| Increased value, the gas being better 25 per cent. | | | | 52,500 | 0 0 |
| | | | | £133,891 | 8 3 |
| Credit Manchester with 5 per cent. on its outlay of £490,000 | £20,000 | 0 | 0 | | |
| Ditto with its profits | 40,000 | 0 | 0 | | |
| | | | | 60,000 | 0 0 |
| Making the loss | | | | £73,891 | 8 3 |

So that the gas consumers of this model city have to pay £52,500 for the depreciation of the quality of their gas, and £21,391. 8s. 3d. for the very superior management of those celebrated gas manufacturers of Manchester. Having disposed of Manchester, we now take a trip to Paris, where we are told that this particular model system also prevails, with the following advantages:—A reduction of 30 per cent. on the previous cost to private consumers, and of 40 per cent. to public consumers, arising from the decrease of establishment charges and an improvement of 24 per cent. in the value of shares. This Paris gas company sold 2,045,130,500 feet of gas in 1858 for £548,918. 10s. 6d., at the very moderate price of 5s. 4d. per 1000 feet; so that the amalgamation has not done very much for Paris. And yet the propounders of this theory would have the gas consumers of Glasgow believe that such a system would enable the Town Council of Glasgow to supply gas at 3s. per 1000 feet. But to show that corporations sometimes make gas cheaply, and to prove that cannel gas ought to be sold in Glasgow at 3s. per 1000 feet, let us see what is going on at Salford. In 1858 the

| | | | |
|---|---|---|---|
| Cost of 1000 feet of cannel gas was | £0 | 2 | 0·16 |
| Interest | 0 | 0 | 5·24 |
| Depreciation-fund | 0 | 0 | 2·63 |
| Income-tax | 0 | 0 | 1·47 |
| | £0 | 2 | 9·50 |

The income derived from gas rent was £28,903. 4s. 7d., and the profit derived during the year applied to public improvements was £7810. 16s. 6½d., and the average selling price to the public 3s. 9d. 72-100ths; the quantity of cannel coal used was 14,413 tons, and the yield of gas per ton 10,540 feet In concluding this subject, for the information of the gentlemen desirous of purchasing the Glasgow Gas-Works, it may not be amiss to show their value by contrasting them with similar works in the City of London. In 1856, Mr. Charles Ansell, actuary to Her Majesty's Customs and the Atlas Insurance Company, was called in to value the works of a modern gas company in London (the Great Central) and an old company (the City of London Gas Company), while considering a proposition to amalgamate the two, and the results were as follows:—

| | | | |
|---|---|---|---|
| The City Company's £150 shares to be reduced to | £78 | 18 | 0½ |
| The Great Central Company's £10 shares to be increased to | 18 | 12 | 4½ |

Or about 5s. in the pound from the old company's outlay.

The meter question has now to be considered. Gas companies can dilute gas by reducing its illuminating power; and, as the meter is only a register of volume, the public have no protection as to quality; and gas may be as dear at 3s. per 1000, through the absence of a power to keep to a proper standard; and the only effectual way to obtain good gas at a fair price is through the medium of a new company. The Statute Labour Committee is elected by the Town Council, and are the owners of the streets for public purposes, and can contract with any company, whether it possesses an Act of Parliament or not, for supplying the public with gas. The Town Council is elected by the ratepayers, and if the monopoly in gas continues, the consumers can avail themselves of the Limited Liability Act, by forming a new company in £1 shares, which will facilitate the objects they have in view far more effectually than any system of monopoly whatsoever. (Loud cheers.)

The CHAIRMAN then put the resolution to the meeting, when it was car-

ried unanimously, and by hearty acclamation. Not a single hand was held up in opposition.

A GENTLEMAN in the area rose up, and was apparently proceeding to call in question some reference made by Mr. Flintoff to Sheffield. The chairman, however, intimated that if he had an amendment to propose, he could not be heard now that there was no motion before the meeting, and the gentleman sat down.

Mr. MELVIN then rose and said: I have been requested by the committee of gas consumers to propose for your consideration, and I hope adoption, the second resolution. I am glad that this meeting has so unanimously adopted the resolution proposed by Mr. Pringle, and that so constitutional and remedial a measure of ascertaining the actual position of the gas companies of Glasgow has been adopted. It will now be for the committee to be afterwards appointed to have this examination conducted in the proper way, so that the consumers may know exactly how the affairs of the companies have been conducted. That is so far well. The consumers are entitled by Act of Parliament to know how the funds have been laid out, how distributed, in what condition the works are, and whether or not a reduction in price can be effected for the consumer. Since that matter has been satisfactorily adjusted, another matter is referred to in the requisition, to which my resolution applies. The resolution I have to move is in these terms:—"That the provisions of the Act 22 and 23 Vic., cap. 66, entituled 'An Act for Regulating Measures used in Sales of Gas,' so far as applicable, should be adopted in this city." Permit me to offer one or two observations in reference to this Act of Parliament. This Act became law on the last day of the session, when it received the Royal assent. It was introduced into the House of Lords by Lord Redesdale, and has been promoted by a committee of gentlemen in London interested in the proper measurement of gas; and perhaps this meeting may be interested to know that till this Act passed there was no special law or rule for the measurement of gas. But now there is a rule, and let it be remembered that it is the only rule whereby gas is to be measured. It provides for something like this:—The foot of gas is measured by a chamber capable of containing 62lbs. and a decimal proportion of a pound weight of pure water; this by the Act is declared to contain a cubic foot of gas. As a law has been very properly enacted that weights and measures shall be tested and adjusted for the interests of the community at large, so this law has been enacted that consumers may see that they get a just measure, and are charged for a proper quantity. There is another provision in this law—viz., that it is permissive on the part of the corporation, as representing the community, to enforce this law. I am glad that this matter has been moved in the Town Council, and I see from the newspapers that the memorial from the Guardian Trade Protection Society on the subject has been remitted to the magistrates, that they may take steps to have the law enforced. That is so far well; and as we claim the right of making remarks when they do what we do not approve, I think they should receive honourable mention when they do well. (Applause.) When this measure was brought before the House of Commons, our respected member, Mr. Dalglish, very much to his credit—(cheers)—gave notice of an amendment, which would have been of great value had it been passed; but it was found that the pressing of the amendment on the part of the honourable member would have probably prevented the bill from passing this session; and, rather than that it should be lost altogether, Mr. Dalglish withdrew his amendment. But it is right, in a public meeting like this, that the public should be made aware of the efficient services of this gentleman. (Cheers.) I find that Mr. Dalglish gave notice that a clause be added to the bill, to the effect that the magistrates of any city or burgh in Scotland be empowered to appoint an inspector to test nightly the illuminating power of the gas, and to report whether it is equal to the power promised to the consumers. (Cheers.) I regret that this clause does not form part of the bill; but I am glad to say that I have a letter from the parties who promoted this bill last year, stating that they propose to bring in a bill to provide for testing the quality of the gas. (Cheers.) Now, seeing that there is a prospect of this Act being introduced next session, I think it is right that, in the meantime, we should urge on the magistrates and Town Council; and I have no doubt that you, Mr. Chairman, in your many efficient services in this public way, will concur in taking care that the inspector be fully qualified not only to inspect the meters, but to judge of the illuminating power of the gas provided. (Cheers.) I believe the magistrates and Town Council are empowered by a clause in the Gas Companies' Acts also to see that the gas is of sufficient illuminating power, but I am not aware that it has been exercised; and now that we hear so much of the gas companies being ready to give gas of less illuminating power at a lower price, we are entitled to see what the illuminating power is, and I have no doubt it will work very well for the city. If the reports of the inspector be published regularly in the newspapers, and it is known that one company supplied gas at one degree of illuminating power, and the other company at so much more or less, then the public will know from whom to purchase. (Applause.) This is a matter in which the corporation is directly and immediately concerned. If I read the estimates aright of the police expenditure for the ensuing year, there is a sum of something like £10,000 or £11,000 for lighting. The police committee are thus the largest customers of the gas companies, and they are entitled to see that the public get full value for their money. It may seem almost unnecessary to ask your opinion in favour of this Act, seeing that it is now the law of the land; but it is important that the Town Council should have their hands strengthened in this matter by the expression of public opinion. (Applause.) Mr. Melvin, after expressing his gratification that the police committee had ordered the necessary apparatus for testing the illuminating power of gas, concluded, amidst applause, by moving the adoption of the resolution which he had read.

Mr. C. J. SMALL briefly seconded the resolution, which was put to the meeting, and carried with acclamation.

The CHAIRMAN said that their respected member, Mr. Dalglish, craved permission to address the meeting for a few minutes. (Applause.)

Mr. DALGLISH then came forward, and was received with loud applause. He said that he took an interest in the subject of the gas movement which was at present going on in Glasgow, and he thought it was his duty, as one of its representatives, to take every opportunity of hearing the sentiments of his constituents on all subjects, and especially upon a subject which was so interesting to the great bulk of this community. Mr. Melvin had stated to them the steps which he (Mr. Dalglish) had taken with regard to Lord Redesdale's bill. That bill, unfortunately, came down to the House of Commons at a very late period of the session; it was one of those bills which were, in fact, bustled through the House. No one had time to consider it; and perhaps the bill was so well drawn up that it did not require much consideration. But in looking over the bill it struck him that, however desirable it might be to have the most accurate measure possible for gas—however desirable it might be that the meters should be regularly tested, and that they should have a stamp put upon them—he thought it was still more desirable that, as gas was not a thing one could see in the same way as one could see a pound of sugar, there should be, in addition to a correct means of measurement, some test that it was really gas which the consumers were getting. (Laughter.) He had met the members of the deputation which had been sent to London in favour of the bill—namely, Mr. Melvin and Bailie M'Adam—and, having had communications with various parties who appeared anxious that the bill should pass, he thought it his duty to support the bill. But at the same time he took an opportunity of stating to the House that he would propose to amend the title of the bill, by adding to it the words, "and the quality of gas," and by inserting in the bill the clause which Mr. Melvin had just referred to. This would have made the bill much more perfect. He had, however, the very next morning, various parties coming to him and stating, "If you persist in this amendment you will throw out the bill for this session." He (Mr. Dalglish) answered, "At all events let us discuss it." They said, "No, you will raise opposition. The bill is a good bill for its purpose, so far as it goes, and we beg you will withdraw your proposed amendment." He said he would, provided they would bring in a bill amending it next year, and give a measure providing means of testing the quality of gas. He was glad to hear by the letter which Mr. Melvin had received that the parties were prepared to introduce a bill next session for that purpose. He would not enter into or discuss the gas question here: he did not think it would be desirable that he should do so here to-night. They had had it fully discussed, but that discussion had been all on one side. (Hear, hear.) All he would state to this meeting was, that in looking at the charges made by gas companies there had always been a difficulty in his mind on one point: he found that a man who used a small quantity of gas—a man who occupied a house of £5, or £6, or £10, and who would necessarily require to consume a smaller quantity of gas—was charged 5s. per 1000 feet, and the man who, consumed 50,000 or 60,000 feet immediately got a deduction of 15 per cent Now, we could easily conceive that in his own establishment the sale of ten yards of cloth would force him to make a greater charge than the sale of a large quantity. ("Hear, hear," from Mr. Moir.) He could understand his friend Mr. Moir, who called out "Hear, hear,"—(laughter)—selling a quarter of an ounce of tea—("Hear, hear," and laughter)—selling it at a dearer price than he would sell a large quantity. But gas and water were very different. The gas and the water were carried along the streets into every man's house by pipes—these pipes, if people were to be supplied, must be there—there was no difference in the delivery of the article—(hear, hear)—and he could not conceive a sound reason why a poor man should pay 5s. per 1000 feet and the great consumer pay only 4s. 3d. As to the illuminating power of the gas, what he wanted was the application of a mercantile test. If the Glasgow companies were getting too much money for their gas, if it was possible to make gas at a very much reduced rate in this city, he trusted that some company would be got up that would fairly test the question. That is what he called a mercantile test. Then as to the difference in the value of 1000 cubic feet of gas, he thought the test there was the value of the light given by each 1000 cubic feet. They were told that in Liverpool the gas was better than in Glasgow, and that it was sold at 3s. 9d. per 1000 feet. His impression had been that the gas in Glasgow was better than the gas in any other part of the kingdom. He was not prepared to go into that question, but he thought the chairman, in his place in council, should insist upon an inspector of the quality of gas being appointed, and that he should have a place at the company's works into which a pipe should be led, for the purpose of testing the quality of the gas, not once a week or twice or week, but every night, by a photometer. He did not know that as yet the photometer was a very perfect instrument, but it was the most perfect that could be had for testing the quality of light. He hoped that Councillor Moir would urge the appointment of such an officer, who would report to the public authorities as to the quality of gas produced by the companies in the city of Glasgow. (The honourable gentleman resumed his seat amid loud applause.)

Mr. PRINGLE then said: In reference to a remark made by Mr. Dalglish about Liverpool, permit me to say that, by Act of Parliament, the one Glasgow company is bound to make gas equal to 12 sperm candles, and the other gas company equal to 10 sperm candles. In Liverpool they are bound by contract to make gas equal to 18 sperm candles, therefore there can be no mistake about this.

Mr. DALGLISH said: I am not prepared to enter upon any discussion. I believe, as you state, that the Glasgow companies are bound to make their gas equal to 10 or 12 sperm candles, but I am told that for a considerable period they have not had gas at a less illuminating power than 26 sperm candles.

The CHAIRMAN: That will be proved by and by. (Laughter.)

Councillor RAEBURN said he would not detain the meeting by any observations, but would simply move the resolution which had been put into his hands:—"That the following gentlemen be appointed, and are hereby appointed a committee, with power to carry out the foregoing resolutions, and to add to their number—viz., Messrs. R. Dalglish, M.P., John Tennant (St. Rollox), Jas. A. Campbell, G. S. Wilson, John M'Dowall, Adam Pringle, Wm. M'Adam, James Arthur, Wm. Melvin, Samuel M'Culloch, Robert Smith, Alex. M'Kenzie, Robert Wyllie, Charles E. Irwin, Archibald Arrol, John M'Donald, Chas. J. Small. Mr. Pringle, convener."

Mr. MATTHEW BULLOCH, without any remarks, seconded the resolution, which was put to the meeting, and carried unanimously.

A vote of thanks to the chairman terminated the proceedings.—*Glasgow Daily Herald.*

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## ANALYSIS OF THE REPORT BY THE PREFECT OF THE SEINE ON THE WATER SUPPLY OF PARIS.

By M. GUILLAUME,
Secretary to the French Society of Civil Engineers.

(Extracted from *Les Nouvelles Annales de Construction, April*, 1859.)

The Report of the Prefect of the Seine contains six chapters, which embrace the whole system of arrangements determined on for procuring the water for the supply of Paris, for its distribution, and for the general system of drainage dependent thereon.

### *Preliminary Observations.*

The immense works executed in ancient times for the conveyance and distribution of water at Rome, are described in considerable detail by the Prefect of the Seine. It would be impossible to select an example more capable of exciting emulation or of inspiring elevated ideas of the system of works required for the sanitary purposes of a large capital.

According to Frontinus, who was curator of the water supply under Nero and Trajan, fifty-nine channels or covered aqueducts 260 miles in length, of which thirty miles were on arches, conveyed every day to Rome a quantity equal to 327,508,800 gallons of water for a population whose exact extent is not at present known, but which the largest modern estimates reckon at 1,200,000 souls. Thus the supply was at least 273 gallons per

head. This volume of water is equal to nine times the total supply from the Canal de l'Ourcq, and is nearly equal to that of the Marne in summer.

Even at the present day, the city of Rome uses some of the ancient aqueducts which have been restored, raised, or completed. The three sources of supply now existing yield together more than 39,618,000 gallons for a population of 170,000 inhabitants, or 233 gallons per head.

Thus, as the prefect observes, neither the capital of France, nor even that of England, can compare, distantly, their resources of water supply with those collected together by the ancient Romans, or even with those preserved as relics of their inheritance by their successors.

The volume of water at the disposal of Paris at the present time is only 29,273,300 gallons daily—viz.:

| | |
|---|---|
| 1. Canal de l'Ourcq | 24,211,000 |
| 2. Steam-engines at Chaillot, Gros Caillon, and Pont d'Austerlitz | 4,402,000 |
| 3. Supply from Belleville, and St. Gervais' Meadow | 110,050 |
| 4. Supply from Rungis, brought in by the Arcueil Aqueduct | 352,160 |
| 5. The Grenelle Well | 198,090* |

Say 24½ gallons per head for a population of 1,200,000 souls.

This water does not generally arrive at a sufficient height: one-fifth of the town is inaccessible to the water from Ourcq, and of the remaining four-fifths only two receive water at the level of the upper stories of the houses. The water from Arcueil, that from the north, and especially that of the Grenelle Well, are at a much higher level than the Ourcq; but their volume is so inconsiderable that we need scarcely take them into account with reference to the supply of at least three-fifths of the town, or in fact of the portions which contain one half of its population. As regards the water of the Seine, the actual volume obtained from that scource is equally insufficient.

An increased supply of 22,010,000 gallons of wholesome, pure, fresh water, which would raise the average allowance of each person from 24½ to 45 gallons, has been deemed necessary to complete the present distribution. This water is proposed to be brought in at a height of at least 260 feet above the level of the sea.

Having stated these conditions, the prefect proceeds to consider the means at his disposal for raising the above-stated volume of water to the required height. These methods are three in number—hydraulic power, steam-engines, and gravitation.

It was at first proposed to use turbines, by constructing a special weir in the Seine, and then by using the weir at La Monnaie. This system was rejected, for the reason that the motive power of these turbines would be unavailable during the occurrence of floods; and that it would be necessary, in order to ensure an efficient distribution, to organize a subsidiary service of steam power sufficient to raise the whole volume of water required from the river.

Steam-engines have been equally discarded—the new ones at Chaillot serving for an example, where numerous accidents have frequently interrupted the service. In order to guard against these accidents it would appear to be necessary to erect at least double the number of engines theoretically required to be kept constantly at work. In order to raise the 22,010,000 gallons now required, it would thus be advisable to erect nine engines of 100 horse-power; and these ought to be doubled by a second series of nine additional engines, or even by a third, if it were thought requisite, as at the Chelsea Water-Works, to erect a triple set of machinery.

The second disadvantage attending the use of steam power for pumping is, that it entails a very considerable daily expenditure.

"When a nation or a great city desires to supply any one of those public requirements which are equally imperative under all the vicissitudes of its fortune, whether in prosperity or in adversity, two practicable courses present themselves for its adoption—the one requiring at the outset a heavy outlay and an energetic effort, but encumbering the future with only an inconsiderable expense and still less solicitude; the other, less expensive at first, but accumulating every day and every year a heavy financial burthen and constantly increasing care and attention—that nation or that city could have no hesitation in preferring the former course, were they in ever so slight a degree impressed with a conviction of their own permanence, a regard for their glory, or a feeling of the duty they owe to succeeding generations"

Setting aside the particular disadvantages of this or of that class of machinery, the water of the Seine, even above its confluence with the Marne, does not exhibit all those qualities usually considered essential for a town supply, and which it is impossible to impart to it. Filtering would, indeed, restore to the water its translucency, but it would not disengage the heterogeneous matters held in solution, nor would it change its temperature.

The prefect accordingly determined to prefer the system of supply by means of an aqueduct, which forms the basis of a definite project by M. Belgrand, engineer-in-chief.

*Definitive Studies.*

The search for sources of supply which should fulfil the requisite conditions of quality, volume, and altitude, was extended over the whole basin of the Seine. This operation was greatly accelerated by the use of MM. Boutron and Boudet's apparatus for hydrometric analyses. The results given by this apparatus for the present water supply of Paris are as follows, the degrees being in proportion to the total weight of extraneous salts:—

| | |
|---|---|
| Grenelle | 9° to 11° |
| Seine | 17° to 20° |
| Ourcq | 31° |
| Arcueil | 37·5° |
| Prés St. Gervais | 76° |
| Belleville | 155° |

It appears from the experiments of M. Belgrand that the water, which only marks at its source 18° at most on the hydrometer, loses none of its calcareous salts on its passage, but that above that degree the water forms incrustations, and that this defect becomes rapidly greater in proportion to the increase of the calcareous salts. This limit of 18° is equally convenient when considering the purity of the water. We are, therefore, justified in fixing 18° as the hydrometric "maximum" for the sources of supply round Paris.

The basin of the Seine, of which Paris occupies nearly the centre, comprises the jurassic, cretaceous, and tertiary formations, each composed of a certain number of strata, permeable and impermeable.

Those waters which fall on the permeable beds do not remain on the surface; they descend to the lower beds, and there form springs, which only appear on the surface at some few points in the bottoms of valleys, where the ground sinks beneath the level of the spring, and there afford an abundant and inexhaustible supply. Those, on the other hand, which fall on the impermeable beds, flow with great rapidity along the surface and in all the depressions that occur therein, and thus form a number of torrential springs, which are swelled and agitated by the lightest rain, and dried up by the shortest drought. If the permeable stratum be of no great thickness, its regulating influence is but slightly felt, and the conditions of the supply are preserved equal'y remote from either of the extremes above stated.

It was, therefore, advisable to search amongst the larger permeable strata for some abundant sources of supply, homogeneous in quality and constant in volume.

The springs in the chalk and in the jurassic formations are the only ones which fulfil these conditions. Setting aside those of the jurassic district on account of their distance, the search was of necessity restricted within the circle (itself of vast extent) bounded by the outcrop of the cretaceous strata.

The great chalk springs form powerful tributaries to each of the main affluents of the river—the Yonne, the Seine, properly so called, the Aube, the Marne, the Aisne, and the Oise.

Considerations bearing on the course of the aqueduct caused us to set aside the springs of the Aisne and the Oise. There remained, then, those of the Seine, with its affluents, the Yonne and Aube, and those of the Marne—the only two rivers which, on leaving the cretaceous district, direct their course nearly in a straight line to Paris. Of the former group the springs of the Vanne might be brought by the valleys of the Marne and the Seine; of the latter, those of the Somme-Soude might be conveyed along the valley of the Marne. Further comparison induced us to give the preference to the second group, which yields the purer water, and is, besides, capable of being brought in at a higher level, and more convenient for distribution.

But, previous to the adoption of any definite measures, it was thought advisable to ascertain whether the tertiary district in the more immediate neighbourhood of Paris did not contain springs of equal value and more easy of access.

With the exception of some springs flowing into the Loing, and which might have contributed their quota to the supply from the Vanne, the springs of the tertiary district in the valley of the Seine are either contaminated by peat, are too deeply impregnated with calcareous matter (selenite), or, lastly, are insufficient and irregular in volume. In the valley of the Marne, on the other hand, the Sourdon—one of the sources of the Cubry, whose hydrometric value is 20° or 21°—would discharge 1,901,664 gallons every twenty-four hours into the aqueduct of the Somme-Soude. Nearer Paris, the Dhuis—an affluent of the Surmelin, giving 23°—would afford a further supply of 5,062,300 gallons, without exceeding the hydrometric limit before laid down as the basis of our investigation.

*Project for the Aqueduct of Supply.*

Our object is not simply and solely to conduct the waters of the Somme-Soude into an aqueduct of supply. In this way we should fail to avoid the disadvantages which would lead us to keep out river water from our consumption. The extremely permeable district which is intersected by the valleys of the Somme and Soude overlies one continuous sheet of water. Every depression of the surface sufficiently deep to cut through this water-bearing stratum gives rise to springs more or less abundant. In order, therefore, to obtain an abundant supply of pure water in the valleys of the Somme and Soude, it would only be necessary to cut, at certain distances, trenches or headings into the body of the water-bed which stretches under the entire district; and thus, by means of this effective drainage, to form artificial springs, which would be conducted to the head of the aqueduct of supply. The quantity of water which would be thus collected cannot be estimated beforehand; but there is little doubt that these districts, so dry on the surface, and yet containing beneath the surface a reservoir of excellent water, would yield all that is required for the consumption of Paris, without showing any sensible diminution in the volume of the rivers.

The supply from the springs of the Somme and Soude would give us no idea whatever of the capabilities of their common source. These springs, in fact, only carry off the higher rills which escape therefrom, and their volume is but a very imperfect indication of the quantity of water likely to be obtained by means of deeper drainage.

From the observations made throughout the entire Paris basin, we may infer that at the time when the gaugings were effected, in October, 1855, the waters of the Somme-Soude had fallen almost to the lowest level ever attained by them, even once or twice during a century. Now, when gauged separately, the springs alone which lie scattered along the course of the two rivers between Somme, Sous, Soude and Conflans, gave a collective supply of 22,173,314 gallons every twenty-four hours. Certainly, if the observers could have penetrated into the heart of the underlying water-stratum by deeper drainage, they would have obtained a far more abundant supply of water, and would have proved the possibility of drawing the supply of Paris from this source, not only without exhausting, but even without sensibly diminishing it.

The springs of the Somme and Soude were but indifferently defended against the drought of 1858; the higher ones were completely dried up, and the lower ones considerably diminished. Those springs which have ceased to flow, still show the water at the surface of the ground; and they also indicate the level of the water-bed, which has fallen about 26 feet. This fact proves that by forming trenches in the valleys of the Somme and Soude to catch the water, the depth of which should be calculated from the experiment of 1858, the water-bearing stratum would be penetrated at a point within a very short distance from the surface, where no drought could affect it.

If, on the other hand, the administration contented itself with drawing only a portion, say one-half, of the supply afforded at the surface from the springs whose confluence at Conflans forms the Somme-Soude, other tributaries are rendered available by this project of supply, in the shape of the springs observed in the environs, or along the course of the aqueduct towards Paris. First, near the village of Vertus, there occur the sources of the Berle, an affluent of the Somme-Soude, whose yield, as gauged in 1857, amounted to 3,081,400 gallons of water every twenty-four hours. Then the Sourdon, whose sources spring from a mass of millstone grit supported on beds of clay and green marl without any appearance of gypsum, in the neighbourhood of St. Martin d'Ablois, whose waters indicate 20° to 23° of the hydrometer, and yield a supply equal to 1,760,000, or sometimes 1,980,000 gallons, every twenty-four hours.

Lastly, the Dhuis, whose yield is 6,162,800 to 7,703,500 gallons in the twenty-four hours, and whose water indicates 23° by the hydrometer, would yet form with the water of the Somme-Soude, the Berle, and the Sourdon, a suitable combination, whose mean hydrometric value would range between 17° and 18°. As to its temperature, it would be constantly maintained at between 10° and 12°.

We now proceed to describe the various works required for this large water channel.

Catch-water drains will be constructed laterally at the Somme, the Soude, and the small affluents known as the Ruisseau du Mont and the Popelet. Then, also, at the Vertus rivulet, the Sourdon, and the Dhuis; and lastly,

* These figures are literally translated, but they are far from correct.

if required, at the Coole and the Vaure. The total length of these works will reach to 76,533 yards.

The Aqueduct, properly so called, measured from the confluence of the catch-water drains to the point of its arrival at Paris on the heights of Belleville, gives a total length of 200,402 yards.

The aqueduct will be continued uninterruptedly in cutting or in tunnel, and will be buried at least a yard beneath the surface. In crossing valleys it will be carried on arches, whenever the height of such arches shall not exceed 33 feet. In crossing valleys of greater depth, syphons will be employed.

From its starting point, the aqueduct is carried towards the north-west across the chalky plains of Champagne, through the long hills of which it is carried in tunnels, and afterwards traverses the tertiary slopes of La Brie; on the left outlet of the valley of the Marne, in the neighbourhood of Epernay, after having cleared the ravine of Cramant by a tunnel through the solid chalk 4800 yards in length. It then crosses the Cubry by means of a syphon 834 yards long, and receives at the other outlet the waters of the Sourdon. From this point it follows the left bank of the Marne, half-way up the hill, over the Strasbourg Railway. But, shortly after the aqueduct enters the department of the Seine-et-Marne, several projections are met with which render it necessary to abandon the hill side, and to have recourse to tunnelling. At Chalifert, the aqueduct crosses the Marne, and keeps along the plain on its right bank until it arrives at the reservoir at Belleville.

The total length of the aqueduct is made up as follows:—

| | | |
|---|---|---|
| In cutting . . | 154,506 | yards |
| In tunnel . . | 31,212 | „ |
| On arches . . | 6,696 | „ |
| In syphons. . | 7,988 | „ |
| Total . . | 200,402 | yards |

The total number of tunnels will be . . . 30
„ „ aqueducts on arches . 13
„ „ syphons . . . . . 11
„ „ bridges . . . . . 17

From its commencement at Conflans to the junction with the supply from the Dhuis, the water-way will be 5 feet wide by 6 feet 10 inches high. From this point to Paris it will have a circular cross section, 6 feet 10 inches diameter. The syphons will consist of two cast-iron pipes, 3 feet 3 inches diameter, in the upper portions, and 3 feet 6 inches diameter at the lower ones.

The fall of the aqueduct will be about 6 inches in a mile.

The loss of head in the syphons is estimated at 3 feet 6 inches in a mile.

From this we perceive that the water-line, which stands at 348·92 feet at Conflans, will descend 59·23 feet in the 109¼ miles of open water-way; and of 15·81 feet in the 4½ miles of syphons; which gives a total loss of head of 75·04 feet, and a final altitude, on its arrival at the reservoir, of 273·88: being thus 105 feet higher than the level of the water of the Canal de l'Ourcq at the basin of La Villette, and 27 feet above the upper reservoir at Passy.

The cost of this great undertaking is estimated at £1,040,000, or about £6700 per mile, viz.:—

| | |
|---|---|
| For works . . . . . | £752,988 |
| For cost of acquisition of ground 33 feet wide, and contingencies. . . . . | 287,012 |
| | £1,040,000 |

This figure has been raised to £1,200,000 by the advice of the Conseil Général des Ponts et Chaussées.

*Distribution of the Old and New Supplies.*

We have one very important remark to make, and that is, that the sole object of this scheme is to supply the inner division of Paris; and now that the city extends to the fortifications, increasing its extent two-fold, and adding 400,000 souls to its population, or perhaps 1,000,000 before the close of the century, a considerably increased supply, at an entirely different level, becomes a matter of evident necessity.

For this purpose, keeping in view the recent annexation of the outer communes, we see already that the supply from the Vanne will in its turn become indispensable; and still the supply would not reach some of the higher points in the outer circle, particularly the hill of Montmartre, which attains a level of 423·12 feet; the plain of Belleville, which reaches to 419·84 feet; and that of the spur at Gentilly, whose level is 249·28. Thus we arrive at this conclusion, viz.—that in order to supply these localities it would be necessary to bring in the Dhuis and the Sourdon at a higher level by a separate aqueduct, or even to go back to the more remote springs of the jurassic district.

Confining ourselves to the old boundaries, Paris will receive, after the execution of these works, a total volume of water amounting to 45,780,800 gallons of water every 24 hours, viz.:—

| | | |
|---|---|---|
| By the aqueduct of supply . . . . . | 22,010,000 | gallons. |
| By the Canal de l'Ourcq . . . . . | 23,110,500 | „ |
| By the supply from the north, from Rungis, and from the Grenelle well . . . . | 660,300 | „ |

The water of the new supply will be entirely devoted to domestic and industrial purposes, as far as may be required; the surplus only will go to supply the elevated districts which are inaccessible to other sources.

It is evident that this division of the service would require two parallel systems of pipes. But as the present distribution is much more extended than the public service requires, the new supply might be at once laid on through the greater part of the old pipes, and the system completed according to the progressive requirements of private consumption.

The execution of the reservoirs, however, cannot be thus put off. They will be three in number: that at Belleville, capable of containing 22,010,000 gallons of water at a level of 273·88; that at Montrouge, of equal capacity, but the water in which does not rise above 262·40, on account of the head to be allowed for in the pipe connecting the two reservoirs. The third already exists at Passy, and contains 5,502,500 gallons at a level of 236·16, and 2,541,200 gallons at a level of 246·00. Of this quantity, 7,043,200 gallons would be supplied from the new source, and the remainder from the artesian well at Passy and the steam-engine at Chaillot.

I do not propose to enter into any detailed description of the system of new pipes which would be required in the course of some future period to complete the double system of distribution above described, and would comprise—

1. For Private Supply.

| | | |
|---|---|---|
| Principal and sub-mains, from 12 in. to 43 in. diameter . | 109,880 | yards. |
| Service-pipes, 4 in. to 8 in. . . . . | 469,587 | „ |
| Total . . . . . | 579,467 | „ |

2. For Public Supply.

| | | |
|---|---|---|
| Principal and sub-mains . . . . . | 82,219 | yards. |
| Service-pipes . . . . . | 167,061 | „ |
| Total . . . . . | 249,280 | „ |
| And, for the two services, a total length of . . . . | 828,747 | „ |

The cost is estimated as follows:—

| | |
|---|---|
| Reservoirs on the hills of Chaumont and Montrouge . . . . | £152,000 |
| Works of supply which would be at once required, and contingent expenses . . . . . | 248,000 |
| Total . . . . . | £400,000 |
| And for ulterior works . . . . . | 320,000 |

Making a general total, for the entire supply, of £720,000

*Underground Drainage of the City.*

The superficial inundations which take place after every heavy shower of rain, in the lower districts on the right bank of the river, clearly prove the insufficiency of the outlet of our present system of sewers, and particularly of that known as the "*collecteur de ceinture*," constructed over the old brook of Menilmontant.

In the new sewers, about 8 superficial yards of outlet have been allotted to every square mile of surface to be drained. The basis on which this calculation was made was the storm of June 8th, 1849, which in the space of one hour poured over the city a sheet of water 1.77 inches in thickness. It is admitted, that on account of the various obstacles in its course, it would take three hours to remove this water by the sewers.

But as the new main sewers on the right bank would of necessity stop back the underlying bed of water which inundates periodically the cellars in the northern quarter of Paris, it has been judged indispensable to contrive an outlet for this water by means of openings constructed in the sides of these sewers. (This course was recommended some time ago in a notice by M. Vingner.) In accordance with this view, a culvert of brickwork in cement will be constructed under the invert of the main sewers, into which the overflow of the underlying water will be conducted through numerous drain-pipes, while at the same time the sewerage waters are prevented from filtering through to the soil.

The occasional floods of the Seine present, under existing conditions, another obstacle to the outflow of the sewerage waters. To remedy this defect, the great trunk sewer which discharges itself at Asnières, was undertaken, advantage being taken of the 5 feet 6 inches fall in the river between this point and the Pont de la Concorde. This sewer will also receive the drainage from the sewers on the left bank, by means of a double syphon of wrought-iron, 3 feet 3 inches diameter, crossing under the bed of the river from one bank to the other, at a depth of 6 feet 6 inches under low-water mark. The secondary mains will continue in communication with the Seine by means of various transverse sewers, principally by that under the Boulevard de Sebastopol; these communications, however, would be closed by flood-flaps when the water rises.

In short, the arrangements determined on will enable us to carry out the underground sewerage by means of those communications, which, according to the terms of the Decree of May 26th, 1852, were required to be made between every house and the nearest sewer.

We have thus two systems before us, viz.:—

Where privies have been suppressed, and the soil-pipes communicate directly with the special drains constructed in the sewers, pumps worked by steam exhaust the entire system of sewers, and force the matter brought down into distant reservoirs, where it is treated and prepared for agricultural purposes.

Where filtering apparatus are employed, which only deliver the drainage water into the sewer after it has been deprived of its fertilizing principle and rendered equally inoffensive and useless, the solid residue, the bulk of which is very small, is carried off under ground in trucks which traverse the principal sewers. In the same manner the solid detritus is disposed of, and instead of being spread on the public roads, is thrown through a gulley into the tunnel of communication before alluded to.

The second system would do away with the annoyance of reservoirs, larger in extent, and quite as offensive as those at Bondy. The preference should, for this reason, be accorded to it, if the experiments now in progress respecting the deodorisation of the sewerage waters lead to a satisfactory conclusion.

Lime-water, it appears, is only partially efficacious; and better results are looked for from the salts of magnesia, which have now been employed for some time in the treatment of the sewerage of the Halles Centrales.

Be this as it may, the present drainage project is so contrived as to apply equally well to either system. Drains built in cement will be constructed throughout the city, either in the thickness of the foundations or under the invert of the sewers; and the water-closets of the houses along the river banks will either communicate with these drains by means of soil-pipes, or with the sewer itself, by a branch-pipe constructed agreeably to the Decree of 1852.

The projects prepared by the municipal engineers for the normal drainage of Paris comprise the construction of 61,691 yards of sewers, of large and average sections and of various forms, and of 254,549 yards of sewers of small section, making in all 316,240 yards. From this calculation are omitted, in the first place, 12,132 yards of existing sewers, the level of which must be raised in order to enable them to deliver into the main sewers; and secondly, 87,440 yards of small sewers, which will be required in portions of the city now almost uninhabited, by reason of the progressive increase of the population.

The total length of the existing sewers, which, with very few exceptions, will be all preserved, amounting to 185,810 yards, the entire system of sewerage will attain a total length of 588,490 yards. The total length of the public roads is only 462,340 yards, but several of the proposed sewers are intended to drain public roads not yet thrown open; and besides, the larger thoroughfares are provided with two lines of sewers.

The complete execution of this entire system would not cost less than £2,000,000; but we should deduct from this sum £384,000 which would apply to the sewers of the new public streets to be opened in Paris, in accordance with the contract between the city and the State. Besides, it is proposed to charge to the householders, by way of compensation for the reduction in the sewers rates, and pursuant to chap. vii. of the law of September 16, 1807, a portion of the cost of construction of those sewers whose execution is not absolutely required for the public service. This contributory portion is estimated at £800,000.

In any case, the sewerage works which are yet to be executed may properly be divided under two heads, viz.:—

| | |
|---|---|
| Those which are now urgently required, and are especially municipal in character, will cost | £400,000 |
| The remaining portion, which are more properly private drains than public sewers, estimated at | 1,216,000 |
| Total. | £1,616,000 |

*Ways and Means.*

By comparing the various figures expressing the outlay required both for bringing in the new water supply and for the reservoirs, mains, and sewers, we obtain the following results:—

IMMEDIATE OUTLAY.

| | |
|---|---|
| Aqueduct of supply | £1,200,000 |
| Reservoirs and mains | 400,000 |
| Sewers, deducting a contribution of £80,000 to be levied on the householders on the river banks | 320,000 |
| Total. | £1,920,000 |

ULTERIOR OUTLAY.

| | |
|---|---|
| Completion of water supply | £320,000 |
| Completion of the system of sewerage, deducting £720,000 as above | 496,000 |
| Total. | £816,000 |

Looking at the whole project, the foregoing estimates give the following results:—

| | |
|---|---|
| Proportion of outlay to be charged to the city | £2,736,000 |
| " " " to the State | 384,000 |
| " " " to the householders | 800,000 |
| Grand total | £3,920,000 |

The quantity of water used for domestic purposes was estimated in 1857 at 5,697,728 gallons only per day; and for this insufficient supply the inhabitants paid an annual sum of not less than £291,600.

We may easily assume that the consumption, which is rapidly increasing every day, would reach at least to 11,005,000 gallons, as soon as we could offer to the inhabitants a clear fresh water, taking this at about 1½d. per 100 gallons, the annual return would amount to £292,000.

When we add to this sum the revenue derived from the supplies to the various manufactories and public establishments, we obtain a sum total of £340,000 as the return to be expected from the proposed supply of water, forming a very satisfactory basis for any financial calculations connected with the execution of the scheme.

Various proposals respecting the management of the water supply have been made to the city by manufacturing firms. They may be arranged in the three following divisions:—

1. The simple substitution, during a definite period, of a company for the municipal board, both for public and private supply.

2. The division of the management between the municipal authorities and a company—the former retaining the direction of the public service, supplied from the present sources; and the company undertaking the introduction of the new supply, and the arrangement and maintenance of the private service.

3. The city to undertake the execution of the works, afterwards to be carried on by a purely commercial company, which should take from the city, at a moderate pre-arranged price, the various services laid on under its management, and which it should be authorized to grant to private consumers according to a tariff previously agreed on.

The municipal administration seems to give the preference to this last proposition; but it reserves its decision until it shall have received the sanction of the government.

Such is the vast undertaking to which the attention of the municipality of Paris has been lately directed. The grandeur and unity of its distinguishing features render it, as a whole, a most remarkable conception.

Nevertheless, complete as this project may be, when considering merely the drainage and supply of the city in its present extent, the annexation of the suburban communes enlarges still futher the basis of our calculations. Even now, looking forward to this enlargement, the additional supply from the Vanne is regarded as indispensable. But we have still to consider the drainage of the immense surface added to the extent of the city; and the sewerage must be advanced with the same rapidity as the water supply.

In conclusion, we perceive that it is on a population of 1,600,000 inhabitants, that we must henceforward base our arrangements for the water supply and drainage of the city of Paris, in anticipation of a not very distant future.

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PORTER'S DOMESTIC GAS APPARATUS.—A silver prize medal was awarded at the late Liverpool Agricultural Show to Messrs. J. J. B. Porter and Co., of Lincoln, for their "National Coal Gas Apparatus," for country residences, farm buildings, &c., by which gas of the greatest purity is produced at a small cost, while the apparatus itself is economical and simple.

DEATH FROM INHALING GAS.—At Hastings, an inquest has been held before R. Grouse, Esq., coroner, on the body of the Rev. Robert Abbott, aged sixty, a Baptist minister, of Raunds, Northamptonshire. Deceased, who had accepted the invitation of a small church to preach on three Sabbaths, arrived in Hastings on the 2nd inst., and on the evening of the 6th, after spending the day with one of the deacons, took possession of lodgings in Portland Terrace. He retired to rest in good health about half-past ten o'clock. A gaslight was burning in deceased's bed-room when he went to bed. Nothing more was seen of deceased till the following morning, when his apartment was entered about noon, and he was discovered dead in bed. Mr. Savery, surgeon, was sent for, and on his arrival found the room filled with gas to a suffocating extent. The tap of the burner was partially turned on, and gas was escaping therefrom. There was no indication that deceased had awoke after falling asleep. It was supposed that after he had turned off the supply he must have partly returned the tap, or that he had incautiously blown out the light. A *post mortem* examination on the following day indicated that deceased had died from poisoning by inhaling gas, and a verdict in accordance with the medical testimony was given.

SERIOUS GAS EXPLOSION AT LIMERICK.—Lord Limerick has had a narrow escape from death, owing to a terrific explosion of gas, which took place on Thursday evening, the 15th inst., at his lordship's residence, near the city of Limerick. New gas mains were being laid for the lighting of the mansion by the United General Gas Company, and the work was mostly completed, when, as the workmen were about closing the labours of the day, it became necessary to connect a pipe for the conveyance of the gas to the servants' hall with the main pipe. In the time occupied in executing this business the gas escaped, and the whole of the lower portion of the dwelling, including the servants' hall, became impregnated with gas. A person holding a lighted candle at this time very foolishly came into the room, and immediately the gas became ignited, and a thundering explosion took place, which shook the entire of the edifice, reducing the whole of the furniture in the servants' kitchen and adjoining room to pieces, and causing considerable damage in other portions of the building. The kitchen, which is situated in the southern part of the house, was occupied at the time of the occurrence by a servant—others being in the hall—who was fortunately dragged out, with great presence of mind, by Lady Limerick's maid, and who, with the exception of her hand being slightly burned, was saved from any further injury. Two others of the servants received slight burns in different parts of the body, and were removed to the hospital; but fortunately no life was lost. The library, which is placed directly over the room whence the explosion originated, was also the scene of some injuries, as far as regarded the flooring, which was altogether torn up, and the windows demolished. Most providentially his lordship, who occupied the library during the evening, where he was seated in an arm-chair, had, about ten minutes before the occurrence, left it and removed to an adjoining room. The weight of the bookcases in this apartment resisted the further effects of the explosion in that direction; but, strange to say, the shock was felt in the nursery—the uppermost and remotest room from where the gas exploded—without being at all felt in the intervening apartments, and resulted in having some glasses in the room dashed violently through the windows; but the children who were there at the time remained unharmed. The whole was but the work of a moment, and occurred almost instantaneously in all the apartments described. The amount of damage done is considerable, a large amount of household furniture having been destroyed.

# Price Current.

## CASTINGS, PER TON.

*Average Weight of Cast-Iron Gas-Pipes, per Yard.*

| 1¼ in. | 2 in. | 2½ in. | 3 in. | 4 in. | 5 in. | 6 in. | 7 in. | 8 in. | 9 in. | 10 in. | 12 in. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 21 | 28 | 33 | 51 | 70 | 89 | 107 | 126 | 149 | 177 | 208 lbs. |

| Retail Prices are 5 to 10 per cent. higher. | London. | Glasgow. | Newcastle. | Wales. | Yorkshire, Derbyshire, and Staffordsh. |
|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Pig Iron, No. 1 | 3 15 0 | 2 12 6 | 3 5 0 | 3 5 0 | 3 10 0 |
| 1¼ and 2 inches Socket-Pipes | 7 0 0 | 6 0 0 | 6 5 0 | 6 10 0 | 6 15 0 |
| 2½ and 3 " " | 6 10 0 | 5 10 0 | 5 15 0 | 6 0 0 | 6 5 0 |
| 4 and 5 " " | 6 0 0 | 5 0 0 | 5 5 0 | 5 10 0 | 5 15 0 |
| 6 in. and upwards " | 5 15 0 | 4 15 0 | 5 0 0 | 5 5 0 | 5 10 0 |
| Retorts, 1st fusion, hot blast | 5 10 0 | 4 10 0 | 4 15 0 | 5 0 0 | 5 5 0 |
| " 2nd " cold " | 6 10 0 | 5 5 0 | 5 10 0 | 6 0 0 | 6 5 0 |
| Tank Plates, ⅜ thick and above | 6 0 0 | 5 0 0 | 5 5 0 | 5 10 0 | 5 10 0 |

## WROUGHT-IRON TUBING,

*Subject to 40 per cent. Discount.*

| | 2 in. | 1½ in. | 1¼ in. | 1 in. | ¾ in. | ½ in. |
|---|---|---|---|---|---|---|
| | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Patent Welded Tubes, from 2 to 12 ft., perft. | 1 8 | 1 0 | 0 10 | 0 7 | 0 5 | 0 4½ |
| " " " 6 in. to 18 in., each | 3 0 | 2 0 | 1 9 | 1 3 | 1 0 | 0 9 |
| Connecting-Pieces, or Long Screws | 3 6 | 2 3 | 2 0 | 1 6 | 1 2 | 0 11 |
| Bends, Springs, and Elbows—wrought iron | 3 9 | 2 3 | 1 9 | 1 0 | 0 10 | 0 8 |
| Tees, wrought or cast | 4 0 | 2 6 | 2 0 | 1 6 | 1 1 | 0 10 |
| Crosses, wrought or cast | 4 6 | 3 0 | 2 6 | 2 0 | 1 6 | 1 2 |
| Iron Cocks | 17 6 | 9 6 | 7 6 | 4 6 | 3 3 | 2 6 |
| " with brass plug | 28 0 | 16 0 | 13 0 | 7 0 | 5 6 | 4 6 |
| Diminishing Sockets, Caps, Plugs, and Plain Sockets | 1 3 | 0 9 | 0 8 | 0 6 | 0 5 | 0 4 |
| Syphons, 2 quart | 15 0 | 14 0 | 13 6 | 13 0 | 12 0 | — |

## COALS, PER TON.

| *Newcastle.—Unscreened.* | | *Scotch Cannel.* | |
|---|---|---|---|
| Whitwell Primrose | 6s. 3d. | Boghead, at Leith | 45s. 0d. |
| Medomsley, Eighton Moor, and Burnhope | 6 6 | Kirkness, best | 23 0 |
| Pelaw | 6 9 | Capeldrae, 1st quality | 20 0 |
| New Pelton, Peareth, South Pelaw, Washington Hutton, and South Peareth | 7 0 | " 2nd " | 12 6 |
| Pelton | 7 9 | Lesmahago, at Glasgow | 25 0 |
| Ramsay's Newcastle Cannel | 16 0 | " " Leith | 27 6 |
| | | Arniston | 22 0 |
| | | Wemyss | 20 0 |
| | | Knightswood | 18 0 |
| | | Pirnie | 15 0 |

## SUNDRIES.

| | | | |
|---|---|---|---|
| Best Newcastle Fire-bricks | per 1000 | 50s. 0d. | |
| Cliff's Fire-bricks, at Wortley | per 1000 | 57 6 | |
| Ingham's Fire-bricks, at Wortley | " | 55 0 | |
| Fire-clay Retorts | per foot run, 5s. 6d. to | 7 0 | |
| Tough Cake Copper | per ton | £107 10s. | |
| English Pig Lead | " | 22 0 | |
| Welch Bar Iron, in London | " | 6 15 0 | |
| Tarred Rope Yarn | per cwt. | 26s. 0d. | |
| Foreign Spelter | per ton | £20 5 0 | |
| English Block Tin | " | 136 0 0 | |
| Banca | " | 144 0 0 | |

## FREIGHTS.

| *Coastwise—Newcastle.—Per Ton.* | | *Foreign.—Per Keel.* | |
|---|---|---|---|
| Chatham & Rochester | 6s. 0d. | Boulogne and Calais | £8 0 0 |
| Cork | 9 0 | Barcelona | 23 0 0 |
| Dover | 6 6 | Bordeaux | 15 10 0 |
| Dublin | 9 6 | Cadiz | 15 0 0 |
| Exeter Quay | 8 0 | Copenhagen | 9 10 0 |
| Folkestone | 6 6 | Dieppe | 8 17 6 |
| London (Pool) | 5s. 9d. to 6 0 | Genoa | 21 0 0 |
| Lowestoft & Yarmouth | 5 0 | Hamburg | 9 5 0 |
| Lynn | — | Havre | 9 10 0 |
| Portsmouth | 8 0 | Leghorn | 21 0 0 |
| Plymouth | 9 0 | Lisbon | 16 0 0 |
| Ramsgate | 8 3 | Rotterdam | 7 15 0 |
| Whitstable | — | Stettin | 10 10 0 |
| Weymouth | 7 0 | Trieste & Venice | £25 to 27 0 0 |

**GAS.—Wanted, by a Young Man** (aged 20) accustomed to Gas-Works, a Situation in that line as CLERK, METER INSPECTOR, or ASSISTANT to ENGINEER.
Address WM. ISAACS, 28, Mount Street, Everton, LIVERPOOL.

TO GAS COMPANIES.

**WANTED, by the Advertiser** (age 19 years), a SITUATION under an Engineer or Manager of GAS-Works. Is a good draughtsman, writes a good hand, and having been engaged in a Work for several years, has a general knowledge of gas-making.
Applications to be made to GEORGE COTTON, Manager, Gas-Works, WARWICK.

TO DIRECTORS OF GAS COMPANIES.

**THE Advertiser is in want of a** Situation as MANAGER in Gas-Works or FOREMAN in a large Work; Main and Service-laying, Meter Inspector, and Gasfitter, having had thirteen years' experience in the above department.
First-class Testimonials and security given.
Apply to J. G., care of Messrs. PORTER and Co., LINCOLN.

TO GAS CONTRACTORS.

**THE Queenstown Commissioners** will receive TENDERS from parties willing to contract for LIGHTING ONE HUNDRED PUBLIC LAMPS with Gas of the best quality for THREE YEARS, from the 1st of JANUARY, 1860.
Particulars may be had on application to J. HAMMOND, Clerk Commrs., Commissioners' Office, No. 1, HARBOUR HILL.
Aug. 16, 1859.

TO GAS COMPANIES AND CONTRACTORS.

**FOR SALE, several lengths of Hy-** DRAULIC MAIN, 14 inches diameter and 6 feet 9 inches long, with 7 holes for Dip-Pipes.
Also, 4-inch ASCENSION-PIPES, 3-inch ARCH and DIP PIPES, and D MOUTHPIECES, all in excellent condition, and will be sold at a very low price.
To be seen on application to the ENGINEER, at the Equitable Gas Company's Works, Lupus Street, PIMLICO.

**WROUGHT-IRON Guides for Gas-** HOLDERS, when Trussed upon scientific principles, are more capable of resisting strains, in every direction, than Cast Columns of any form can be; and weigh only one-fifth as much as the latter. Designs and Working Drawings for Guides and Ties can be obtained of the Inventor, CHARLES DIXON, C.E., Chichester, SUSSEX.

**EIGHTON MOOR GAS COALS.—** Parties wishing to be supplied with these first-class Gas Coals will please to apply to Mr. MATTHEW NESBIT, EIGHTON MOOR OFFICE, NEWCASTLE-UPON-TYNE. These coals are well known as among the richest in gas, and working the roundest on the River Tyne. They are extensively used by metropolitan gas works.

**ALLAN and CO.'S Patent Compen-** SATING GAS-METER.
For Drawing and Description of this Meter see THE JOURNAL OF GAS LIGHTING, No. 175, of July 19, 1859, pp. 405, 406.
Application for information to be made to, and licenses granted by, ALEXANDER ALLAN, Engineer, PERTH, and the Meters may be had of JOHN MILNE, Maker, Milton House, EDINBURGH.

GAS PURIFYING BY REVIVIFIABLE OXIDE OF MANGANESE.

**MR. LAMING** (Inventor of the Revivified Oxide of Iron Purification) begs to inform Gas Engineers that they may now supersede the material in general use by A REVIVIFIABLE OXIDE OF MANGANESE of his preparing, which in efficacy is at least equal, and in economy superior, to Oxide of Iron. Owing to the greater chemical activity of Manganese, common dry-lime purifiers of ordinary capacity will often be amply sufficient for it, though they may be too small for the Oxide of Iron material.
For Gas-Works possessing steam power, more especially such as are exposed to public complaint, Mr. Laming recommends the purification to be done either wholly or in part (depending on extent of apparatus) in out-of-doors scrubbers, hermetically sealed, by means of his liquid process, which is both economical, and meets all practical requirements.
118, Fenchurch Street, Aug. 1, 1859.

**CANNEL and COAL of the best de-** scriptions for making GAS and COKE.
(As per Analyses.)
GAS CANNEL, 17s., 15s. 6d., and 14s. per ton.
GAS COAL, 11s. 6d., 9s. 6d., and 8s. 6d. per ton.
STEAM COAL, 10s., 9s. 6d., and 9s. per ton.
All free on board Vessels in Liverpool.
Handpicked Cannel and Coal about 10 per cent. additional. Concession in prices made for large quantities.
GAS APPARATUS of all descriptions, and on the most approved principles; also Purifying and other materials supplied.
ANALYSES, PLANS, and ESTIMATES, and other information required, and the highest references furnished on application.
CONTRACTS for Materials and Works entered into.
No charge made for Superintending Shipments, Preparing Bills of Lading, or passing Entries.
**EMANUEL TURNER and CO.,**
EXPORT OFFICES:
34, CASTLE STREET, LIVERPOOL.

**THOMAS PHILLIPS,**
55, SKINNER STREET, SNOW HILL.
PATENTEE and MANUFACTURER of all kinds of Apparatus for Cooking, Heating Baths, Conservatories, &c., by Gas, and general Gas-Fitter by Appointment.

**J. CLIFF'S Fire Bricks, Clay** RETORTS, &c.

Orders for London and South of England to be addressed to Mr. NEWTON, Agent for the District, 16, Castle Terrace, New Hampstead Road, KENTISH TOWN, N.W.
N.B.—A few Retorts of each size, and a large stock of Bricks and Lumps, always on hand at the above Wharf.

**ROBERT MACLAREN and CO.,** EGLINTON FOUNDRY, GLASGOW, Manufacturers of all sizes of Cast-Iron Main Pipes, by an improved Patent. General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

**M. SHEEN, Gas and Railway** Lantern Maker, 204, Holborn Hill, begs to inform Managers of Gas-Works, &c., that she continues to contract and supply Lanterns on reasonable terms, and keep them in repair by the year.

**WEST and GREGSON, Gas-Meter** MANUFACTURERS, &c.
UNION STREET, OLDHAM.
Station and Experimental Meters, Gas Pressure Registers, Gauges, Experimental Gasholders, Governors, Slide Valves, &c. &c.
W. and G. would respectfully call the attention of Gas Engineers and Managers to their Station-meters, having made and erected the largest in use at the present time, two of which may be seen at the Stockport and Liverpool Gas Works, on application to the respective Engineers.

**WILLIAM RYDER, General** MINERAL AND METAL AGENT AND MERCHANT, 4, DEAN STREET, NEWCASTLE-ON-TYNE,
is prepared to supply Gas and Water Companies with Apparatus and Appliances of every description, including Cast and Wrought Iron Goods, Coals, Fire-Bricks, Retorts, &c. &c.
Any communications addressed to him as above shall have prompt attention.

**WILLIAM STEPHENSON & SONS,** THROCKLEY,
NEWCASTLE-ON-TYNE,
MANUFACTURERS OF EVERY DESCRIPTION OF FIRE BRICKS, CLAY RETORTS, LUMPS, TILES, &c. &c.
LONDON OFFICES:
76, KING WILLIAM STREET, CITY.
A large stock of Fire-Clay Goods always on hand in London, at the lowest wharf prices, at Messrs. CHRISTIE & Co.'s Wharf, 64, Bankside, SOUTHWARK.

FIRE BRICKS.

**THE MACHEN COLLIERY** COMPANY, NEWPORT (MON.).
Shippers of Fire-Goods of First-class quality manufactured from a remarkably pure seam of Fire-Clay.
Railway Communication by Broad or Narrow Gauge with all parts of the Kingdom, and by Seaboard, Coastwise, and Foreign.

**CAST-IRON Retorts, Socket Pipes,** with Syphons and all requisite Connexions, Lamp Columns, Wrought Iron Tubing, Valves, Street Lamps, Sight Holes, Furnace Doors, Ash Pans, Charging and Coke Shovels, Iron Pails and Coke Barrows, Cross Bars, Fire Pots, Pumps, Iron Borings.
PURIFIERS, CONDENSERS, and SCRUBBERS erected complete, or the materials supplied; with every description of goods in use by Gas-Works, in stock, on wholesale prices, at
Mr. LYNCH WHITE'S,
Old Barge Iron Wharf, Upper Ground Street, LONDON.

**W. DONALD and CO.,** Manufacturers of IMPROVED GAS-METERS, 35, Britannia Street, CITY ROAD.
N.B.—These Meters cannot be overcharged. Warranted to register correctly, according to Act of Parliament.

**ADDISON POTTER,** WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of Clay Retorts, Fire Bricks, and every description of Fire Clay Goods.

**CHARLES BOTTEN and SON,** ENGINEERS & METER-MAKERS,
CRAWFORD PASSAGE, RAY STREET,
CLERKENWELL, LONDON (E. C.).
Manufacturers of Station and Patent Protector Consumers' Meters, Patent Slide-Valves, Gas-Fittings, Pipes, &c.
Also, High-pressure Cocks, Hydrants, Closets, and all Water-Fittings.

**KINSON FIRE BRICKS are inde-** structible by heat, and are warranted to last twice as long as Stourbridge, Newcastle, or Welsh bricks. 80s. per 1000 at Nine Elms Station.
WORKS: POOLE, DORSET.

**JOHN ROGERSON and CO.,** NEWCASTLE-ON-TYNE & MIDDLESBRO'-ON-TEES.
Wrought and Cast Iron Pipes, Cast-Iron Retorts, and all kinds of Foundry Work necessary for Gas-Works. Fire-Bricks and Clay Retorts. Gas Coals of every description. Pig, Bar, and Plate Iron.

**GEORGE ANDERSON, Gas and** CONSULTING ENGINEER,
104, LEADENHALL STREET, LONDON (E.C.).
DIRECT-ACTING GAS-EXHAUSTERS,
supplied either with or without Steam-Engines and Boilers.
FOUR-WAY DIAPHRAGM VALVES,
one of which answers the purpose of THREE ordinary Valves, as applied to Purifiers, or in shutting off and passing Station-Meters, Governors, or other apparatus, while the Connecting-Pipes are also much simplified.
RETORT SETTINGS,
designed to be heated by Tar alone, and with a tota absence of Smoke.
Illustrated circulars, giving references and every information, may be obtained on application as above.

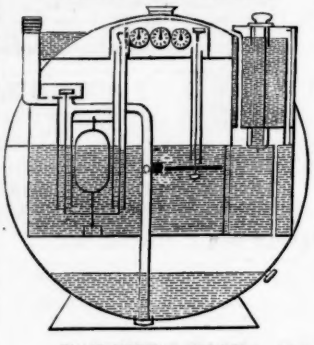
TO GAS & WATER COMPANIES, ENGINEERS AND FITTERS.

**GARSIDE'S Registered Tube-Vice** holds all sizes of Wrought-Iron and Brass Tubes with the greatest firmness and least possible pressure; consequently it is not so liable to split or damage the Tubes as the ordinary Vice, and considerably facilitates the Workman, who may do almost double the quantity of work. Also,
GARSIDE'S IMPROVED MAIN-DRILLING CLIPS, for Drilling Holes for Service-Pipes. With this instrument the perforation of Pipes for the attachment of smaller Tubes can be effected with great ease and precision. Likewise,
HEAP'S REGISTERED GAS TONGS, most highly approved of as vastly superior to those in present use. Stocks, Taps, and Dies, together with all tools connected with Gas Engineering.
For Drawings, Testimonials, and prices, apply to the Maker, S. GARSIDE, Stamford St., ASHTON-UNDER-LYNE.

**WALTER MABON, Engineer,** ARDWICK IRON WORKS, FAIRFIELD STREET MANCHESTER,
Manufacturer of
IRON TANKS for Gasholders, Railway Stations, &c.
GASHOLDERS.—Extensive premises at Gorton, solely for the manufacture of Gasholders, and other heavy Wrought-Iron Structures.
GAS APPARATUS.—W. M. has an extensive assortment of patterns for Purifiers from 4 feet to 15 feet square, also round ones from 4 feet to 10 feet diameter; Scrubbers, Condensers, Washers, Columns, Girders, and Tripod Patterns, suitable for Gasholders, from 10 feet to 150 feet diameter, either Single-lift or Telescope. Contractor for Gas Works of any Magnitude. Designs, Specifications, and Estimates furnished.
WROUGHT and CAST IRON ROOFS for Railway Stations, Gas Works, Warehouses, and Sheds, prepared for Slates or for Corrugated Iron.
IRON HOUSES, either for Dwellings, Manufactories, or Public Buildings.
PIPES and VALVES, for Gas and Water, from 2 inches to 48 inches bore.

**THE IMPERIAL IRON TUBE COMPANY,**
(SUCCESSORS TO GEORGE B. LLOYD & CO.,)
GAS STREET AND BERKLEY STREET,
**BIRMINGHAM,**
**Manufacturers of Wrought-Iron Tubes & Fittings,**
FOR GAS, STEAM, AND WATER.
PATENT GLASS ENAMELLED AND GALVANIZED TUBES,
AND
**LAP-WELDED IRON BOILER TUBES.**

PATENT WET METER.



# N. DEFRIES,

CONSULTING GAS ENGINEER,

**Inventor and Patentee**

OF

## WET GAS-METERS,

WITH SELF-ADJUSTING WATER-LINE;

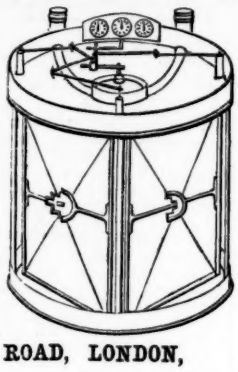
## DRY METERS,

GAS-HEATING BATHS, OVENS, STOVES,

**GAS FIRES with INDESTRUCTIBLE FUEL,**

*&c., &c.*

PATENT DRY METER.



**FACTORY: DIANA PLACE, FITZROY SQUARE. OFFICE: 406, EUSTON ROAD, LONDON,**
**Eight Doors from Factory.**

Attempts having been made to construct Self-Supplying Apparatus to Wet Gas-Meters upon the Bird Fountain principle, which, although unerring to supply water in the open atmosphere, has not wholly succeeded so as to be relied upon when enclosed in a Gas-tight Meter Case,—N. DEFRIES begs leave most respectfully to acquaint Gas Companies, and the Public in general, that he has constructed his PATENT WET GAS-METER upon a method entirely different, being founded on the well-known principle of the self-acting supply of the Oil Lamp, which has never been applied for the adjustment of the Meter Water-Line before, and which, by the admission of external air to a chamber sealed from Gas, will never fail to faithfully perform its required function. They are of the very best materials and workmanship, will stand more pressure than is required as the test for soundness by the New Act, are guaranteed to prevent surreptitious burning without detection, and will be kept in repair free of charge for seven years.

## N. DEFRIES'S CELEBRATED DRY METERS,

of which more than 80,000 are in use in Palaces, Churches, Chapels, Royal Dockyards, Club Houses, Public Offices, and other Buildings throughout the Empire and Continent, which have done so much in checking surreptitious burning, and simplified the fitting up of Gas.

To remove any doubt of accuracy of measurement his Meter for 1500 lights, in use upwards of ten years at the Royal Italian Opera, until that Building was destroyed by Fire, was long afterwards dug out of the burnt ruins, then tested by the Chartered Gas Company in the presence of George Lowe, Esq., F.R.S., and other Chief Officers, and found inflexibly correct. Also, on the 9th of June, 1858, at the Western Gas-Works, his Meter for 150 lights, after considerable use, was doubted, and subjected to the most variable tests—from the full lighting to a single Jet—and in each case, as in other instances, accuracy was finely indicated.

As to durability, his two large Meters at the Thames Tunnel have been in use night and day for upwards of twelve years—one continuation of dark hours—subjected to the wear and tear of seventy-five years as compared with the ordinary business hours of using Gas above ground.

## LORD REDESDALE'S SALE OF GAS BILL.

**All Meters constructed by N. DEFRIES are guaranteed to pass the Provisions of the Standard.**

No alteration has been necessary in the Meters he continues to supply to the Chartered, Imperial, City of London, Equitable, and other large Companies, his accustomed range of 1 per cent. over and under meeting all the desired requirements; whereas, by the New Act, a greater departure from accuracy—viz., 2 per cent. fast to 3 per cent. slow—is permitted.

## ESSON'S PATENT
## COMPENSATING GAS-METER

**Is guaranteed correct within the meaning of the "Sale of Gas Act."**

MANUFACTURED ONLY BY

## WILLIAM COWAN,

**Buccleuch Street Works, EDINBURGH;**

AND

**Commercial Chambers, Ridings Court, St. Mary's Gate, MANCHESTER.**

ESTABLISHED 1827.

## ALEXANDER WRIGHT,

GAS ENGINEER, MANUFACTURER OF GAS-METERS, GOVERNORS, AND EVERY DESCRIPTION OF GAS APPARATUS,

**55, MILLBANK STREET, WESTMINSTER.**

CONSUMERS' METERS at the List Price, with a Liberal Discount to Wholesale Purchasers.

THOMPSON'S BROMINE TEST, £1. 1s.—BROMINE, 3s. per Ounce.

BISULPHURET OF CARBON TEST, £2. 2s.

APPARATUS FOR DETERMINING THE HEATING POWER OF SAMPLES OF COAL AND OTHER DESCRIPTIONS OF FUEL, £5. 5s.,

INVENTED BY LEWIS THOMPSON, ESQ., M.R.C.S.

REGISTERING PRESSURE GAUGE, Net Price, £8. Glass Shade, 10s. extra.

STATION METERS, PRESSURE GAUGES, PHOTOMETERS, SPECIFIC GRAVITY APPARATUS, &C.

**LORD REDESDALE'S "SALE OF GAS BILL" having received the sanction of the Legislature, Gas Companies and Consumers are respectfully informed that ALL Meters made at this Establishment are constructed most carefully to meet the requirements of this Act.**

**WRIGHT'S COMPENSATING METER possesses peculiar claims on the attention of those who desire to obtain a most simple and thoroughly efficient instrument at a moderate price.**

PATENT FLEXIBLE GAS TUBING, VULCANIZED INDIARUBBER HOSE-PIPES, WASHERS, PACKING, &c.

**JAMES LYNE HANCOCK** begs to announce a considerable REDUCTION in PRICE of his PATENT VULCANIZED INDIARUBBER TUBING.

VULCANIZED INDIARUBBER AIR-TIGHT BAGS, any size, for Gas Mains, with flexible tubes attached, and fitted with stop-cocks complete.

Manufactory and Warehouse, No. 6, Goswell Road, LONDON (E.C.).

**WHITEHOUSE and CO., Boiler and GASHOLDER MAKERS,**

GLOBE PATENT TUBE WORKS, WEDNESBURY,

Beg to draw the attention of Engineers and Managers of Gas Works to the superior quality of the Article they manufacture, both in respect of the iron employed, and the perfect manner in which it is welded; in proof of which they can refer to the testimonials of the most eminent Gas Engineers, and the experience of the principal of the large Gas Companies of the kingdom. Orders promptly executed.

**ALFRED PENNY,** Engineer,

WENLOCK IRON WORKS,

WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY begs to inform Gas and Water Companies that he undertakes the erection of new, or the alteration of existing, works; and that he may be consulted generally on all matters connected with gas and water supply. He is also prepared to supply best Cold-blast Retorts, Socket-Pipes, and Connections, Iron Borings, &c. &c., and all the necessary Castings used in Gas and Water-Works.

*** Country orders executed with care and despatch

## GRANT AND CO.'S
## PATENT COMPENSATING GAS-METER,

**Which secures accuracy of registration by its maintaining a true water-line under every circumstance, by a simple contrivance which is not liable to get out of repair; requiring little attention, they being self-acting—as the water is again used that is left, after supplying what has been lost by evaporation.**

**GAS-METER WORKS: EDINBURGH.**

---

# JAMES MEACOCK,

## PATENT DRY AND WET GAS-METER MANUFACTURER,

**7, SNOW HILL, AND 16, WEST STREET, LONDON.**

**ESTABLISHED 1836.**

**JAMES MEACOCK** begs to thank Gas Companies and the Trade generally for the very liberal support awarded him in his Patent Dry Gas-Meter; his Improvement in connecting the Diaphragm between Metal Rings, cemented and screwed to the Tin Frames, being pronounced by Gas Engineers to be the most perfect improvement to the Dry Meter since its introduction.

J. M. invites attention to his Improvements in **EXPERIMENTAL WET GAS-METERS**, by which he renders impossible any **Leakage from the Stuffing-Box.**

**These METERS are GUARANTEED to meet all the REQUIREMENTS of the SALE OF GAS ACT.**

---

## GOVERNORS, STATION-METERS. PHOTOMETERS,

EXPERIMENTAL TESTING GASHOLDERS, HIGH-PRESSURE GAUGES,

AND ALL APPARATUS IN USE AT THE GAS MANUFACTORY.

---

# EDWARD COCKEY & SONS'

## PATENT GAS VALVES.

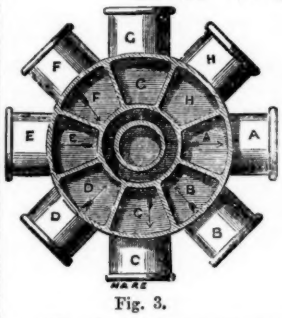



Fig. 3.

THESE Valves are formed of two cast-iron cylinders, with segmental divisions, having faces ground gas-tight, the upper cylinder turning horizontally on the lower one.

The lower cylinder has pipes from each division communicating with the vessels to and from which gas is to be passed. The upper cylinder has corresponding divisions, so arranged as to direct the passage of gas to the different segmental divisions in the lower part, and when it is turned on the face of the lower one to alter the flow of gas from one vessel to another.

Fig. 4.

Fig. 3 represents an arrangement for four purifiers, in which, by turning the upper cylinder, Fig. 4, the Gas is directed through three purifiers, and either one in rotation left out for cleaning.

A slight variation of this arrangement adapts the Valve to three purifiers, passing the Gas through two of them, and having each one in rotation out of use.

Another arrangement is just completed for two purifiers, by which the Gas may be directed through both purifiers together, entering either first, or through either purifier separately. The advantages of this arrangement will be too manifest to Gas Manufacturers to need comment.

The Valves are manufactured by the Patentees at their

**IRON WORKS, FROME SELWOOD.**

The following Testimonial has been received from an eminent Engineer:—

*Gaslight and Coke Company's Office, Cheltenham, Jan.* 17, 1859.

Messrs. Cockey and Sons, Frome.

Gentlemen,—The Patent Purifier Centre Valve which I had fixed instead of the common hydraulic valve for one of our sets of purifiers with 9-inch connexions, I am happy to say continues to afford satisfaction both to myself and to the workmen who have the charge of it.

I am, Gentlemen, yours truly, W. ESSON.

---

## EDWARD COCKEY AND SONS

ALSO MANUFACTURE

PURIFIERS, SCRUBBERS, CONDENSERS, AND OTHER IMPROVED GAS APPARATUS,

HAVING PATTERNS SUITABLE FOR GAS-WORKS OF DIFFERENT SIZES.

# WILLIAM PARKINSON AND CO.,

(SUCCESSORS TO THE LATE SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.,

PATENTEES AND MANUFACTURERS OF

**GAS-METERS, GOVERNORS, AND OTHER APPARATUS;**

ALSO,

**METERS FOR MEASURING WATER, &c., &c.**

IMPROVED LOW-SPOUTED GAS-METERS,

Which completely meet the requirements of Lord Redesdale's Sale of Gas Act, and are as simple in their construction, satisfactory in working, and as low in price as the well-known Meters which have been made by W. P. and Co., and their predecessor, Mr. Samuel Crosley, during the last forty years, and of which there are about 300,000 now in use.

STATION-METERS AND GOVERNORS

*Of all Sizes, of the best Construction, Materials, and Workmanship, supplied on the shortest notice.*

There are about 300 Station-Meters at work of their manufacture, of sizes varying from 750 to 60,000 cubic feet per hour, of which the following are some of the principal ones, recently supplied by them to London Gas Companies, viz. :—

| | | | | |
|---|---|---|---|---|
| 2 | for | 60,000 | cubic feet per hour | each to the Chartered Gaslight and Coke Company, Westminster; |
| 1 | ,, | 40,000 | ,, | ,, Chartered Gaslight and Coke Company, Brick Lane; |
| 2 | ,, | 60,000 | ,, | ,, London Gaslight Company, Vauxhall; |
| 1 | ,, | 60,000 | ,, | ,, Commercial Gas Company, Stepney; |
| 1 | ,, | 40,000 | ,, | ,, Equitable Gas Company, Pimlico; |
| 1 | ,, | 40,000 | ,, | ,, Phœnix Gaslight Company, Greenwich, |

*&c. &c. &c.*

And they have also supplied large Station-Meters to the Gas Companies at Birmingham, Nottingham, Sheffield, Southampton, Leeds, Newport, Glasgow, Manchester, Dublin, Cork, and all the principal towns in the United Kingdom, as well as many on the Continent, &c., &c.

Their Station Gas-Governors have been adopted by most of the above-named Companies, and have given universal satisfaction.

**PRESSURE REGISTERS, EXPERIMENTAL METERS, PHOTOMETERS,**

**Minute Clocks, Consumers' Gas-Governors, Pressure-Gauges,**

**STANDARD EXPERIMENTAL GASHOLDERS FOR PROVING METERS, &c.**

GEORGE LOWE'S PATENT NAPHTHA BOXES AND MOTIVE-POWER METERS,

WITH MACHINERY FOR WEIGHTS TO ASSIST THE SUPPLY OF GAS WHERE THE PRESSURE IS LOW.

**SPECIFIC GRAVITY APPARATUS, RAIN GAUGES, &c.**

---

**JAMES OAKES and CO.,**

ALFRETON IRON WORKS, DERBYSHIRE,

AND

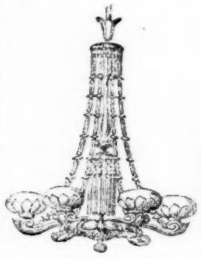
WENLOCK IRON WHARF, 20, WHARF ROAD, CITY ROAD, LONDON,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including best cold-blast Iron Retorts, Socket and Flange Pipes of all sizes, Bends, Branches, Syphons, Lamp Columns of various patterns, &c.

N.B.—Orders for Cast-iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

CHARLES HORSLEY, Agent.

C. H. is prepared to carry out the warming and ventilation of public buildings, &c.; also civil engineering in general.



**F. & C. OSLER,**

45, OXFORD STREET, LONDON;

*Manufactory—Broad Street, Birmingham—Established* 1807,

MANUFACTURERS OF GLASS CHANDELIERS, GLASS LUSTRES, TABLE GLASS, &c. &c.

ELEGANT CRYSTAL GLASS CHANDELIERS, for GAS, from £4 upwards (Made from "REGISTERED" DESIGNS), with GLASS BRANCHES, &c.; suitable for DRAWING-ROOMS and BALL-ROOMS. The more extensive use of GAS in private dwellings has induced Messrs. OSLER to direct their particular attention to the manufacture of this class of articles—which, with a view to their general adoption, are offered at very moderate prices. Purchasers can select from a great variety of patterns, to which additions are being constantly made.

THEATRES, CONCERT, ASSEMBLY, AND BALL ROOMS LIGHTED BY ESTIMATE ON THE LOWEST TERMS.

---

BOULTON'S PATENT

**DRY GAS-METERS,**

Of which upwards of 24,000 are at present in use, having gained for themselves an unparalleled patronage from all the principal Gas Companies and Consumers, on account of their unerring registration and the superior workmanship and materials used in their construction, enables the Patentee to sell them now at competitive prices with those of other makers.

Every description of Improved Wet or Patent Dry Meters and Gas Apparatus manufactured by

**JOSEPH BOULTON**

28, BAGNIGGE WELLS ROAD, CLERKENWELL.

THE UNIVERSAL

**GAS-BURNERS REGULATOR,**

(GEYELIN'S PATENT,)

The only one in the world by which the flame from Argand, Fish-tail, and all other Burners remain invariable under all variations of pressure, and the cost of each light is less than one farthing per hour.

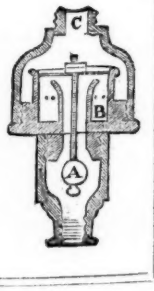
Can be fixed horizontal, close to, or distant from, the Burner; is ornamental, simple in construction, consisting of a double chamber, the inner perforated, covered with a diaphragm giving action to a spherical valve.

**PRICE 3s. EACH.**

*Can at all times be seen tested at the Manufacturer's,*

**JOSEPH BOULTON**

28, BAGNIGGE WELLS ROAD.



# FIRE-CLAY GAS RETORTS.

ESTABLISHED IN 1795.

## JOSEPH CLIFF,

### WORTLEY FIRE-BRICK WORKS, near LEEDS.

THESE RETORTS are unrivalled in excellence, being the BEST FINISHED INTERNALLY, and THE MOST CORRECT IN FORM, of any in the Kingdom. From the peculiar composition used in working up the face of the material, they are rendered unusually smooth, close, and FREE FROM SURFACE CRACKS, thus, in a great measure, preventing leakage and the adhesion of carbon to their interior surface.

To meet the yearly increasing demand of UPWARDS OF THIRTY SEASONS and to carry out the late improvements in the manufacture, the Premises have been re-erected and much enlarged, and Engineers may rely WITH CONFIDENCE on their orders being completed with a greater regard to despatch than by any other House.

THE WORKS ARE WELL SITUATED

For EXPORT from the Ports of { LONDON, LIVERPOOL, HULL, MIDDLESBRO', HARTLEPOOL, and STOCKTON.

FIRE-BRICKS, LUMPS, GUARDS, TILES, AND CLAY OF THE SAME QUALITY.

**M. B. NEWTON, London Agent, No. 4, Wharf, King's Cross Goods Station.**

---

**PADDON and FORD** respectfully invite the attention of Gas Companies and Managers to their PATENT STREET LAMP REGULATOR, which ensures any required consumption.

By its use a great saving is effected, and the item of "Unaccounted-for Gas" considerably decreased.

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**PADDON and FORD, Patent** GAS-METER AND APPARATUS WORKS, 'GRAY'S-INN-ROAD, LONDON,

Manufacturers of WET and DRY GAS METERS, STATION METERS, GOVERNORS, EXPERIMENTAL APPARATUS, LANTERNS, &c. &c.

Contractors for the erection or alteration of Gas-Works; and every description of Apparatus required in Gas-Works supplied.

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**GEORGE CUTLER, Gasholder** MAKER,

No. 8, WENLOCK-ROAD, CITY-ROAD, LONDON.

Contracts for Tanks, Gasholders, Roofs, Purifiers, and all descriptions of Gas Apparatus executed on the most reasonable terms. Improved Slide Valves, Steam, and Range Boilers, and Smiths' Work, of the best materials and workmanship.

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**WILLIAM CLIBRAN'S Patent** MERCURIAL GAS-GOVERNOR FOR STREET LAMPS.

W. C. begs respectfully to call the attention of Gas Companies to his PATENT GAS-GOVERNOR for STREET LAMPS, upwards of 3000 of which are now in use on Public Lamps. By their use any given quantity of Gas per hour may be consumed with the tap full open whatever the increase of pressure may be, thus preventing a great waste of Gas in many of the Lamps, and securing to the public an uniform light. Prices, 3s. 4d., 3s. 6d., and 3s. 8d. each.

Governors kept in stock from three-eighths of an inch to four inches bore.

Samples and Testimonials forwarded on application to WILLIAM CLIBRAN, 43, Todd Street, MANCHESTER

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**BENJAMIN GIBBONS, Jun.,** DEEPDALE FIRE-CLAY & BRICK WORKS, Near DUDLEY,

Manufacturer of every description of Fire-Bricks, Lumps, Quarries, Shields, Flue Covers, &c., to any size or shape required.

**FIRE-CLAY RETORTS,** TO MODEL OR DRAWING.

B. G. begs to call the attention of Gas Companies to his Fire-Clay Retorts, which have been used with great satisfaction in some of the largest Gas-Works in the Metropolis and many Provincial Towns in England.

References given, if required.

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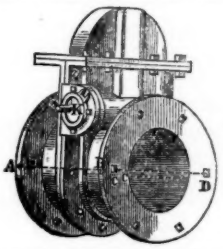

**BRYAN DONKIN & CO.**

keep always on stock their

**IMPROVED GAS VALVES**

from 2 inches to 18 inches, price 11s. 6d. to 13s. 6d. per inch diameter

List of prices, with full dimensions of all sizes up to 27 inches, to be had on application.

These Valves are all proved to 30 lbs. on the square inch before leaving the works.

**BRYAN DONKIN & CO.,**

*ENGINEERS,*

NEAR GRANGE ROAD, BERMONDSEY.

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**BIRTLEY IRON WORKS,** CHESTER-LE-STREET, DURHAM.

Manufactory for every description of Casting and Machinery for Gas Works and Water Works.

Warehouse in London for Cast-iron Pipes and Connections of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Office in London, Mr. E. M. PERKINS, 78, Lombard Street.

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**HARRIS and PEARSON** PROPRIETORS OF BEST CLASS-HOUSE POT AND CRUCIBLE CLAY. MANUFACTURERS OF **FIRE BRICKS GAS RETORTS &C.**

AMBLECOTE FIRE CLAY AND BRICK WORKS, STOURBRIDGE.

*Late in the occupation of I. and W. King. Originally J. Pidcock, Esq.*

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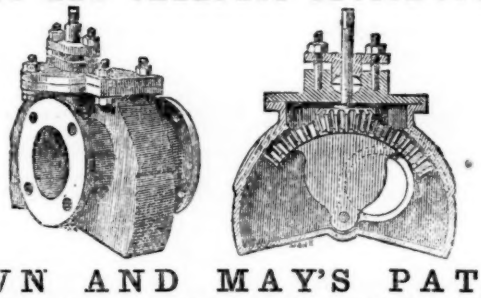
**BEST AND CHEAPEST SLUICE-COCK.**



## BROWN AND MAY'S PATENT.

Above 3-inch diameter, price 10s. per inch. Brass face, 6d. per inch extra.

**Can be taken to pieces without being removed from the line of Piping.**

**NORTH WILTS FOUNDRY, DEVIZES.**

Wholesale Agents, Messrs. S. and E. RANSOME, 31, Essex Street, Strand, E.C., Where a Sample may be seen.

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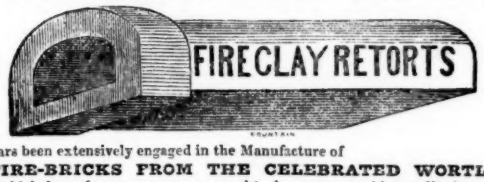
# WILLIAM INGHAM AND SONS,

## WORTLEY FIRE-BRICK AND RETORT WORKS,

Near 

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

**RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY,**

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

**Estimates for Setting, or Bricklayers sent when required.**

**GAS OVENS IN SEGMENTS OF EQUAL QUALITY.**

**London Agents: CHADWICK and AKEROYD, Willington Stone Wharf, Regent's Park Basin.**

**A large stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all sizes kept in London at CHRISTIE & CO.—Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.**

N.B.—*Export orders continue to have prompt attention.*

## LORD REDESDALE'S SALE OF GAS ACT.

## WILLIAM SUGG

Begs to inform Gas Companies and his Customers generally that henceforth all Meters sent out from his Works, both Water and Dry, will meet the requirements of the above Act.

To those Gas Companies who desire a Self-Adjusting Meter, he recommends his "COMPENSATING WATER METER" as a simple and efficient instrument, combining accuracy of registration with protection against fraud, while the slight difference in form between it and the ordinary Water Meter renders the alteration of existing stock a matter of comparative ease and moderate expense.

Those who approve of the non-compensating Meters will find his "WATER-BOX METER" all that can be desired.

**GAS-METER and APPARATUS WORKS: 19 and 20, MARSHAM STREET, WESTMINSTER.**

## SALE OF GAS ACT.

## MESSRS. CROLL, RAIT, AND CO.,

**Manufacturers of Croll's Patent Improved**

## DRY GAS-METER,

being informed that several Gas Companies are under the impression that Dry Meters will not be allowed by the above Act, beg to say that such is not the case, inasmuch as the Act embraces "every kind of machine used for measuring gas," and provides for the testing of the same, in its 13th clause.

Speaking for themselves, and of the Meters manufactured by them, C., R., and Co. have the gratification of knowing that not one single Meter out of the large number they have sold, will, when tested by an Inspector, be rejected; and, consequently, that neither Gas Companies nor Consumers who have these Meters in use will be put to one farthing expense for alterations.

C., R., and Co. always adopted the unit of measure provided for by the 2nd clause of the Act, and have never allowed themselves a greater latitude than 1 per cent. either fast or slow, and they intend to adhere to these limits, notwithstanding that the Act allows 2 per cent. fast and 3 per cent. slow.

C., R., and Co.'s Meters register most correctly all the gas passed through them, whether it be the smallest quantity or the full complement for which the Meters are made; and *they are prepared to give written guarantees to Purchasers that the Meters shall, when tested by an Inspector on his appointment under the Act, be approved of by him as correct. In the event of such not being the case, the Purchaser to be entitled to return the Meters to C., R., and Co., and claim from them their cost, together with any expenses incurred by their rejection.*

Further, C., R., and Co. undertake, during a period of five years from the date of purchase, to put into good order, free of charge to the Purchaser, any Meters of their manufacture which may become defective.

## CROLL, RAIT, AND CO.,

DRY GAS-METER MANUFACTURERS,

**CANAL BRIDGE, KINGSLAND ROAD, N.E.,**

are prepared to supply

**STANDARD CUBIC FOOT MEASURES,**

of the Capacity required by the 2nd Clause of the Act,

**as well as Gasholders correctly graduated thereby.**

**STATION-METERS, GOVERNORS, PRESSURE-REGISTERS, AND OTHER GAS APPARATUS SUPPLIED.**

*Particulars given upon application.*

## D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,

**PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,**

invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

**MANUFACTURERS OF**

**GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;**

DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;

**IMPROVED FULL-WAY CARTER'S VALVES (much approved of);**

GAS-STOVES, and every article connected with Gas Apparatus.

CAST & WROUGHT-IRON PIPE, BLACK & GALVANIZED. COPPER. TIN, BRASS, & COMPOSITION TUBING.

**D. HULETT'S IMPROVED SERVICE CLEANSER**

for clearing out Mains, Services, and Interior Fittings—60s. net.

*Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns.*

**Sole Manufacturers of Church and Mann's Photometer.**

Large Pattern Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.


London: Printed by WILLIAM BOUGHTON KING (at the office of Joseph Clayton, 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Sept. 27, 1859.